

Situation Semantics and its Foundations

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Declaration

I declare that this thesis has been composed by myself and that the research reported therein has been conducted by myself unless otherwise indicated.



Ivan D. Blair

Edinburgh, 17th December 1984

For my parents

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Abstract

The aim of this thesis is to examine several aspects of situation semantics and to evaluate the contribution which the theory makes to our understanding of language, in particular whether it brings us nearer to a solution of some traditional puzzles with attitude reports.

The presentation is in three parts. The first part, comprising chapters one and two, consists of a general introduction to the issues involved and tackles the question of where situation semantics places the boundary between semantics and pragmatics. The second and main part, chapters three to six, is devoted to demonstrating the language-dependent status of abstract situations. The interpretations of expressions and the role of the setting in composition are analysed in chapter three. In chapter four I consider Russell's views on propositions and the Russellian semantics Richards has given. Chapter five examines in detail the suggestion of chapter three that the level of abstract situations is not independent of language, recasts situation semantics accordingly as an interpreted language, and lastly considers an extension of situation semantics to include molecular facts. In chapter six situation semantics is related to direct reference semantics. Finally, chapters seven and eight treat attitude reports, analysing firstly the ingredients of Barwise and Perry's approach to the semantics of the attitudes, and secondly setting out some traditional puzzles and considering how situation semantics deals with them.

The goal throughout is to clarify and understand what the ideas and insights behind situation semantics are and to determine their importance for semantic theory.

Preface

Although situation semantics burst upon the world only a few years ago, it has been, and continues to be, the subject of much interest and inquiry. Consequently, the theory has developed rapidly, having already assumed several forms. This state of affairs, in which the theory is constantly shifting, proves problematical for anyone attempting to write a major work on the theory; the situation has been intensified with the institution of the Center for the Study of Language and Information at Stanford University and the concentrated inquiry into situation semantics and its applications which the Center fosters.

Although contemporary theory has already moved beyond Situations and Attitudes, published in 1983, which will be the main source for most interested people, I chose to base my analysis upon that version. The aspects of situation semantics that I am concerned with are fortunately less variable, and the points which I make, though made with respect to that formulation, are not restricted to it. References are made to more recent versions of the theory where it seemed appropriate.

Remarks on terminology, abbreviation and notation: following more recent usage, I use 'situation' and 'situation type' for what are called respectively 'course of events' and 'event type' in Barwise and Perry (1983). I use the abbreviation S&A for Situations and Attitudes in the notes; references to this book are also made in this form. The conventional mode of reference (author and date) is used in the main text. Indeterminates are printed in bold type, thus: **x** , and not in bold with a period, thus: **ẋ**, as in Barwise and Perry (1983). Finally, I have adopted the convention of underlining algebraic symbols, except when they occur as superscripts or subscripts. Bold characters are not underlined.

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Chapter One: Introduction

1.1 General

Situation semantics is a newcomer as far as semantic theories are concerned, but it is also a rather controversial theory, being radical in many, interconnected respects. In this thesis, by examining some of the aspects which set situation semantics aside from traditional, mainline theories in formal semantics, I shall try to determine what these novel features mean for situation semantics in terms of being able to contribute towards our understanding of language and, in particular, towards solving some difficult and longstanding problems in the semantics of propositional attitudinal reports.

Our examination of situation semantics has three main aspects: (i) partiality in the semantics: the use of situations for the references of sentences (strictly, utterances), thereby purchasing for the theory more finely differentiated references than is the case with its main rivals; (ii) the concept of information and its place (if any) in semantics. This question has two subsidiary facets; firstly, in a semantic theory which appeals to the notion of information, the meaning of semantic innocence needs to be re-evaluated, for if information is given a semantic role, the semantic value has a rival. Secondly and relatedly, there is the problem of the location of the boundary between semantics and pragmatics, and the question of whether this boundary has been moved with situation semantics. Finally, and of central concern, there are (iii) the related questions, What and where is meaning? and, What is the status of the entities in the semantics? Is meaning in the world as Barwise and Perry claim, or does a quasi-linguistic status infuse various actors that are placed on the situation semantics stage?

These issues are linked in an interesting way. The attempt to locate meaning in the world relies on the notions of information advocated for some time by J. J. Gibson and recently by Fred Dretske

to provide structures in the world; thus the issues under (iii) are connected with those under (ii). Moreover, despite the very entities that purchase the partiality, the use of situations and the assignment of structured interpretations to utterances, language infiltrates the semantics and a quasi-linguistic status attaches to situations (as I shall show).

In choosing to focus upon these questions, I am neglecting other interesting aspects of situation semantics, some of which ought to receive mention in this introduction. Firstly, I shall not be examining the underlying set theory, Kripke-Platek admissible set theory with urelements (KPU), as the particular axiomatised theory of sets chosen for situation semantics, which would be a topic for a comprehensive investigation of the foundations of the theory. Our interest in the foundations of situation semantics concerns rather the use to which the set theory is put.

Another issue we shall not pursue is the question of which logic inheres situation semantics. The assignment of classes of situations to utterances of sentences as their references means that not one, but two implicational relations can be defined between utterances: strong and weak consequence. Weak consequence is more familiar as material implication, but it is strong consequence that encapsulates the logic of situations. I shall make a few remarks about the underlying logic below in connection with partiality, but it is not a question I treat in any depth.

Situation semantics places emphasis upon considering language as actually used, by finite agents in situations, to communicate partial information about their environments. The questions of what it means to understand a language, and of what a speaker needs to know in order to understand an expression, would therefore seem to arise more naturally in the theoretical surroundings of Barwise and Perry's semantics than they do in others. It has been argued, notably by Michael Dummett (1975, 1976), that the study of meaning is precisely the study of understanding;¹ however, work in formal semantics (eg. Montague Grammar) has built upon classical model theory and logic, and deals with questions about the relation of

language to the world, to the detriment of questions about the relation of language to speakers. Unfortunately, this whole range of issues must be omitted, since it would deserve a separate treatment.

The main effort is devoted to establishing the language-dependent or quasi-linguistic status of abstract situations: chapters three to six are concerned with this question in one way or another. In these chapters I examine how meaning determines interpretation in situation semantics and argue that while the interpretations of some expressions, such as 'Jackie' and 'biting', may be things in the world, the interpretations of utterances cannot. This issue of what the references or utterances are has been considered by Russell and more recently by Richards, so in chapter four I look at these writers. The Russellian approach has been revitalised by David Kaplan and goes under the name of direct reference semantics, which I look at in chapter six. The main chapter discussing the status of abstract situations is chapter five. The issue of information is treated in chapter seven in connection with attitude reports and the role of the agent's cognitive state.

In the remainder of this introduction I shall outline the issues involved with all three main areas and clarify the content of this work.

1.2 Aspects of situation semantics

1.2.1 Partiality

Partiality is a characteristic and crucial aspect of situation semantics. Although partial functions have been studied thoroughly in recursion theory, their use in model theoretic semantics is more recent and rare. One thinks of Hintikka's use of model sets and van Fraassen's use of supervaluations in the semantics of formal languages.² Partial functions are just what Barwise and Perry need to represent their concept of information. Grounded in Gibson's ecological realism and with insights arising out of Dretske's theory

of information, Barwise and Perry's semantics locates linguistic meaning within the wider context of ecological meaning and information. Its starting point is the detection of limited amounts of information about the world; for an organism always picks up partial information from its environment. Situations are the conceptual and formal tools that have been appropriated to embed partiality within the theory.

In an early paper (Barwise and Perry, 1980) we find two arguments against construing situations as sets of possible worlds. I want to examine these arguments, since they bear on the issue of whether partiality as it appears in situation semantics really is an advance over standard theory or not. The proposal for defining a situation in terms of possible worlds is as follows. We shall assume that the set \underline{A} of individuals is fixed for both representations. Let \underline{I} be the set of all possible worlds, \underline{R} be the set of relations in the situation analysis, and for each $\underline{r} \in \underline{R}$, let \underline{r}' be the predicate (relation symbol) in the possible worlds analysis which denotes \underline{r} . For simplicity we shall omit reference to locations.³ Let $\underline{J} \subseteq \underline{I}$ be any nonempty set of possible worlds; the situation corresponding to \underline{J} is

$$\underline{s} = \{ \langle \underline{r}, \underline{a}_1, \dots, \underline{a}_n, 1 \rangle \mid \forall \underline{i} \in \underline{J}, \langle \underline{a}_1, \dots, \underline{a}_n \rangle \in V(\underline{r}', \underline{i}) \} \\ \cup \{ \langle \underline{r}, \underline{a}_1, \dots, \underline{a}_n, 0 \rangle \mid \forall \underline{i} \in \underline{J}, \langle \underline{a}_1, \dots, \underline{a}_n \rangle \notin V(\underline{r}', \underline{i}) \}$$

The inverse operation can also be defined: if \underline{s} is a situation, then the set of possible worlds corresponding to \underline{s} is that subset \underline{I}_s of \underline{I} defined as follows:

$$\text{if } \langle \underline{r}, \underline{a}_1, \dots, \underline{a}_n, 1 \rangle \in \underline{s} \text{ then } \forall \underline{i} \in \underline{I}_s, \langle \underline{a}_1, \dots, \underline{a}_n \rangle \in V(\underline{r}', \underline{i}) \\ \text{if } \langle \underline{r}, \underline{a}_1, \dots, \underline{a}_n, 0 \rangle \in \underline{s} \text{ then } \forall \underline{i} \in \underline{I}_s, \langle \underline{a}_1, \dots, \underline{a}_n \rangle \notin V(\underline{r}', \underline{i})$$

The arguments against this reduction of situation to sets of possible worlds consist of an example from mathematics followed by the application to possible world semantics. We shall look mainly at the mathematical examples and evaluate those. The first argument revolves around the premise that a property Φ may be said to hold of

a set just in case Φ holds of every member in the set. Identifying the partial function with the set of extensions means that the partial function has a property Φ just in case every total function extending it has the property Φ .

The mathematical example is the function $\sqrt{}$ on the set \mathbb{Q} of rational numbers, SR being the set of all extensions. Now, for every $f \in \text{SR}$, $f(2)$ is defined; hence, on the above mentioned premise, the partial function, identified as the set of all extensions, is defined for the argument 2. But since $\sqrt{2}$ is irrational, the real partial function is not defined in \mathbb{Q} for the argument 2, and this, Barwise and Perry argue, shows the absurdity of identifying the partial function with the set of all extensions of it.

This argument is unconvincing, because the premise upon which it is based is not plausible. One cannot generally attribute a property to a set because every member of the set has the property. Suppose we have a set, each member of which is a man; does this set therefore have the property of being a man? The argument Barwise and Perry give shows rather the absurdity of this premise than the absurdity of identifying a partial function with the set of all extensions of it.

The second argument concerns what happens to this identification when the domain is enlarged from \mathbb{Q} to \mathbb{R} , the set of reals, which has the result that each $f \in \text{SR}$ has now itself become a partial function.

Are we going to identify f with the set of all its extensions and then good old $\sqrt{}$ with this set of sets of functions on \mathbb{R} ? And how can we do this so that $\sqrt{2}$ comes out to be what it ought? Problems like this have convinced mathematicians that partial functions are a way of life, not to be identified with sets of total functions. (Barwise and Perry, 1980, p. 54)

The problem highlighted here involves the basis upon which functions are defined: if we believe that total functions are prior to partial functions, then the definition of partial functions in terms of sets of total functions becomes problematic when there is a shift in the domain -- the total functions are no longer total, and themselves

need founding. If they are construed as sets of yet other functions, then the original partial function is a set of sets of total functions -- until the domain shifts again.

This problem appears in possible world semantics as the problem of fixing at the outset which primitives there are -- which are all the possible worlds and which are all the possible individuals. Reluctance to accept such an a priori and deterministic view are laudable; Barwise and Perry are right when they say 'partial functions are a way of life'. This argument convinces us that we ought not to banish partiality from mathematics, but it does not bear upon the separate argument of whether partiality in situation semantics adds something new to semantics -- that question will be decided by the use to which the mathematical tools (whether partial or not) are put.

One difference that strikes one between Hintikka's and van Fraassen's representation of partiality on the one hand, and Barwise and Perry's on the other is that the latter build partiality into the entities used in the semantics without reference at this stage to language, whereas for Hintikka and van Fraassen, the partiality cannot be exhibited unless the object language is taken into consideration -- indeed, we can see very little of the semantics at all without making reference to the language. This difference is the result of Barwise and Perry's strategy of pursuing semantics independently of language and locating meaning in the world, bound up with an ecological conception of information, to which issues we turn below (section 1.2.3). However, I should like to examine Hintikka's and van Fraassen's semantics here, under the rubric of partiality, and in section 1.3 to raise the issue of whether Barwise and Perry's semantics in fact satisfies the claims made for it.

Hintikka (1962) takes a very different approach to logic from most theorists. He takes as his basic notion the consistency of a set of sentences of the language, not the truth of a sentence. A set of sentences Δ is consistent just in case there is a state of affairs that would make each sentence in Δ true under a suitable interpretation. A model set, the key concept in Hintikka's approach,

is a consistent set Δ , but not every consistent set of sentences Δ is a model set. The concept of a model set represents a further tightening up of the notion of a consistent set of sentences. Hintikka's model set is a consistent set of sentences Γ that satisfies certain conditions, specifying which sentences Γ must contain on the basis of which sentences are already in Γ . For example, if a sentence $A \& B$ is in Γ , then A must be in Γ and B must be in Γ , and if $A \vee B$ is in Γ , then either A is in Γ or B is in Γ . Smullyan calls these downward saturated sets and proves that such sets are satisfiable (Smullyan, 1968, pp. 27,28).

Use of the language is therefore crucial to the embedding of partiality in Hintikka's semantics: there are no situations (partial worlds) in the theory, only partial descriptions of a possible state of the world in terms of the object language, for model sets are sets of sentences.

For van Fraassen, a formal language L consists of a syntactic component, which generates the set of sentences of the language, and a semantic component, a set VL of admissible valuations, each of which assigns a truth value to some, but not necessarily all, sentences of the language.⁴ A supervaluation is defined as follows:

Definition. A valuation s is a supervaluation for L iff there is a nonempty set K of admissible valuations for L such that, for all sentences A of L ,

$$s(A) = T \iff v(A) = T \text{ for all } v \in K;$$

$$s(A) = F \iff v(A) = F \text{ for all } v \in K;$$

$$s(A) \text{ is not defined otherwise.}^5$$

The state of the world, and, as inspection of this definition of supervaluation shows, parts of the world too, are not defined independently of language. The way the world is, is fixed only by fixing which sentences about it are true, and which are false.

This definition of a supervaluation is given in van Fraassen (1971) before the author has provided a semantics for quantificational languages. When he does provide such a semantics, it is in terms of the usual model theory, with a domain D and an

interpretation function \underline{f} , and an assignment function \underline{d} from variables to elements of \underline{D} . The relation of satisfaction \models is defined as usual, the only interesting clause for our purpose being

$$\underline{M} \models (\underline{P}^n \underline{x}_1 \dots \underline{x}_n)[\underline{d}] \text{ iff } \langle \underline{d}(\underline{x}_1), \dots, \underline{d}(\underline{x}_n) \rangle \in \underline{f}(\underline{P}^n).$$

Van Fraassen then goes on to define valuations in terms of model satisfaction:

If \underline{M} is a model for a QCS [quantificational syntax] and \underline{d} an assignment function for \underline{M} , then a valuation of that QCS induced by \underline{M} and \underline{d} is a valuation \underline{v} of that QCS such that

$$\begin{aligned} \underline{v}(\underline{A}) &\in \{ T, F \} \\ \underline{v}(\underline{A}) &= T \text{ iff } \underline{M} \models \underline{A}[\underline{d}] \end{aligned}$$

for all sentences \underline{A} of that QCS (see p. 109). The admissible valuations of a language \underline{L} are those induced by the models and assignments for the QCS of \underline{L} .

There is now a domain of individuals underwriting the truth value that the admissible valuations assign to sentences; yet at the level of the valuations themselves, reference to individuals is hidden. Because the model theory is standard, it shares with the standard theory that theory's language-dependent definition of the semantic concepts of reference, truth and logical consequence. Once he has defined the valuations induced by a model and an assignment, van Fraassen takes his leave of the world: the semantics revolves around the language, and the property of being true, which sentences may or may not possess. Since there is no pressure to interpret truth as correspondence with the world, there is no essential reference to the world in van Fraassen's semantics.

In contrast, Barwise and Perry clearly want to do realist semantics and to bring the world into their theory. The question is whether they actually succeed, whether this is what they have actually done with situation semantics. But we are trespassing on issue (iii).

I shall interpose one brief comment about the underlying logic of situation semantics. An interesting comparison can be made of the

role of partiality in Hintikka's and van Fraassen's systems with its role in situation semantics. For Hintikka, model sets are useful, because they have a certain structure and can be more easily handled than complete models. If the analogy be allowed, they are like nth partial sums of a series. Van Fraassen employs supervaluations to preserve classical logic in dealing with languages which fail to be bivalent (van Fraassen, 1971, pp. 163-172). Thus partiality for both these writers is a methodological partiality. Barwise and Perry on the contrary make more radical claims about the role and importance of partiality for language and information. Yet it is not clear that the model theory they actually provide reflects these claims. Questions arise as to whether their logic is classical or weaker, perhaps a relevance logic, but cannot be dealt with here.

1.2.2 Information

The second group of issues I am concerned with centres on the conception of information: is there a semantic role for information, and what place does the notion have in situation semantics? The concept of information that Barwise and Perry employ is substantially derived from the work of J. J. Gibson and Fred Dretske, but has also been developed by Barwise and Perry themselves. Since the concept is non-standard and, indeed, somewhat controversial, something needs to be said about it in this introduction.

What is the province of semantics and how should semantics be located within the more general theory of language and language use? More precisely, what is the relation of semantics to pragmatics in situation semantics? One issue to be discussed under the present rubric is the location of the boundary between "semantics" and "pragmatics"; the other issue is the meaning of semantic innocence within the emerging structure of the theory.

Gibson has proposed a theory of information that differs radically from the standard notion; it is the concept of information he needed as a psychologist to elaborate and defend his basic position. His approach to cognition has flourished and has come to

be known as the ecological approach. While claiming that situation semantics is an attempt to develop a theory of language and meaning within the school of ecological realism,⁶ Barwise and Perry also derive inspiration from Dretske's work and his attempt to develop a qualitative account of information.

Strictly speaking, ecological realism does not locate meaning in the world alone, but rather information arises out of the interaction between living things and their environment. On the ecological approach, information is objectively there in the environment for organisms to detect, and therefore exists separate from the animal. The approach is ecological realism, not ecological idealism. However, information is not altogether independent of the animal. The ecological psychologists express this by saying that information, and indeed all the phenomena of psychology, "reside" at the level of the ecosystem, and can only be properly understood at the ecological grain of analysis, when both the animal and its environment are taken into consideration. The important point is that the sense in which information is dependent, or better, relative to the animal is not the sense in which for the idealist aspects of the world are dependent on the perceiver. In ecological psychology the perceiver does not confer existence upon certain qualities or aspects of the world; instead the idea is that the animal's being present in the overall picture is conceptually necessary for a coherent and accurate notion of information.

Gibson's position is based on the claim that there is objective information in the world. This is part of his answer to the question, What exists? The ecological approach is not reductionist, seeing reality ultimately as a "dance of quarks", or even for practical purposes (since subatomic physics may continue indefinitely) thinking of atoms as the building blocks of all that there is. The ecological approach accepts that there are different grains of analysis, and espouses two principles, which help to govern what is to be regarded as real:

- (i) The phenomenon at issue must exist within the grain of analysis investigated by the science.

- (ii) The reality to be described must reside wholly within the system over which the description is to be written.

(Michaels and Carello, 1981, p. 98) Atoms and molecules do not have a privileged ontological status for theorists in the ecological school; all things that there are, at whatever grain of analysis, are ontologically equal.

Dretske's work represents an attempt to go beyond the mathematical theory of information of Shannon and Weaver (1949), which is a theory of amounts of information, and to reach a qualitative account of the notion of information, which will hopefully be able to specify the informational content of messages in some way. The way Dretske proposes to do this is by setting out necessary and sufficient conditions for a signal to carry the information that a source s is F. Clearly, this is not the place to go into Dretske's theory in much detail. I shall therefore simply state and explain the condition he finally arrives at and then go on to remark on the influence his work has had on Barwise and Perry.

Informational content: A signal r carries the information that s is F = The conditional probability of s's being F, given r (and k), is 1 (but given k alone, less than 1).

(Dretske, 1981, p. 65) The occurrence of k here is intended to relativise the definition to what the receiver already knows about the source.

This is a de re account of the informational content of a signal; the information transmitted is about the source s, to the effect that it is F, as Dretske emphasises.⁷ In situation semantics, similarly, a situation represents an individual's being thus and so (at a location). For example,

In e: at l: barking, Jackie; yes

involves Jackie herself. Since individuals are themselves constituents of situations,⁸ Barwise and Perry have given us a de re specification of situations.

Some remarks are necessary on the two issues surrounding

information that I want to concentrate on; I shall deal first with the meaning of semantic innocence. Much was made, especially when the theory was first being publicised, of the fact that situation semantics represented a return to innocent semantics. Fregean dominance was being challenged, and all of semantics, it was claimed, would be done within the innocent framework. Even before the book Situations and Attitudes was published, it was becoming clear that working out the semantics of the attitudes was presenting some quite difficult and resistant problems for innocent semantics. Barwise and Perry seem to have gone through some rather acrobatic manoeuvres and contortions in trying to solve, or failing that, to bypass these problems. The reader who examines Situations and Attitudes from an archaeological perspective will find numerous fossils pointing to this meandering history of situation semantics.

The doctrine of semantic innocence is that expressions have the same kinds of reference when they occur in intensional contexts (specifically, we are interested in propositional attitude contexts) as when they occur in extensional contexts. This is what Donald Davidson meant when he used the expression 'innocence':

If we could but recover our pre-Fregean semantic innocence, I think it would seem to us plainly incredible that the words 'The earth moves', uttered after the words 'Galileo said that', mean anything different, or refer to anything else, than is their wont when they come in other environments. (Davidson, 1968, p. 144)

Barwise and Perry mean the same thing when they use the term. They place the following three conditions on an innocent semantics:

- (i) Embedded sentences in attitude reports are syntactic units, parts of the embedding report, and expressions in them work just as they do elsewhere.
- (ii) Names, pronouns, and referential and (outer) attributive uses of definite descriptions have individuals, not senses or meanings or functions, as their semantics values.
- (iii) The principle of substitution of logical equivalents fails.

(Barwise and Perry, 1983, p. 176)⁹

An innocent semantics cannot long avoid confronting the basic problem that motivated Frege to abandon innocence: how can the semantics handle cases, which can easily arise (as Barwise and Perry would agree), where there is a single object in the world that agents have met on two or more occasions, and of which we suppose they have two different ideas or concepts? The agent would be disposed in such cases to make different judgements on the truth or falsity of sentences which differ only in that they contain distinct coreferential expressions designating the object, but which express different concepts. Consider the following example:

- (1) The ancient Egyptians believed that the Morning Star was visible in the morning.
- (2) The ancient Egyptians believed that the Evening Star was visible in the morning.

Since the ancient Egyptians did not realise that 'the Morning Star' and 'the Evening Star' designate the same object,¹⁰ we want to say that (1) is true, but (2) false. An innocent semantics, committed to the view that 'the Morning Star' and 'the Evening Star' always have the same reference (interpretation) cannot explain this change in judgement of truth value. There is a direct conflict between the formal semantics and our intuitive judgement, which has to be explained, if not resolved.

Barwise and Perry's response to this problematic state of affairs is not to abandon innocence, but to restructure their overall theory, altering the role of the interpretation, and, apparently -- though we shall have to clarify this, -- shifting the boundary between semantics and pragmatics in the sense that pragmatics takes on some of the tasks that were formerly regarded as within the province of semantics. The concept of information plays a prominent part in this upheaval. When Barwise and Perry introduce the concept into their theory (see the first chapter of Barwise and Perry, 1983), they ensure that at least some information involved in an utterance is separated from the semantic value or interpretation of expressions by their explicit rejection of what they call the fallacy of

misplaced information:

The Fallacy of Misplaced Information: the idea that all the information in an utterance must come from its interpretation.

One wants to know just what the role being given to (inverse) information is, and in particular, whether it might be said that (inverse) information has a semantic role in situation semantics. Barwise and Perry are, I think, confused about this point, and the fallacy of misplaced information is one manifestation of their confusion.

If information does have a place in the theory, and some of this information is inverse information, ie. it is separate from the interpretation of an expression, then we must ask what the consequences of this are for our understanding of the concept of semantic innocence. If the role of the interpretation is not the usual role of the semantic value, because information has entered the picture, is situation semantics then an innocent theory in the sense defined above?

This brings us to the first aspect of this second constellation of issues, the putative semantics/pragmatics boundary shift and the accompanying upheaval in the structure of the theory. We shall be concerned to find out just what has happened in situation semantics; for at times it seems that little has changed, that the relation between semantics and pragmatics is as it is ordinarily conceived to be, that, for example, truth conditions are still determined in the semantics and all the additions to the standard theory that have been introduced in situation semantics have simply to do with how the theory fits into the wider context of a theory of language use, or perhaps a theory of human psychology. On this view the changes are concerned with factors which had previously been mostly ignored, but are now treated by the pragmatic part of the theory. At other times, certain remarks suggest that a more radical restructuring of the standard kind of semantic theory has taken place, with many semantic factors, as they would be regarded traditionally, now being influenced, if not determined, by traditionally pragmatic features.

The confusion surrounding this point is extremely unsatisfactory and some clarification is necessary.¹¹

1.2.3 Meaning in the world

The third constellation of issues concerns our understanding of meaning -- what kind of a thing is meaning? Barwise and Perry declare their affiliation to the ecological realism of J. J. Gibson and those psychologists who have followed him in locating meaning and information firmly in the world. (This accords nicely with the doctrine of semantic innocence.) In the last section I explained briefly what was involved in Gibson's and Dretske's notions of information. From that it will be clear that Barwise and Perry, following these writers, want to characterise a notion of meaning and information that is objective, in the world. Under the present rubric our concern is to evaluate their work with respect to this goal.

Let us for a moment consider a related issue, discussed by Leonard Linsky in the introduction to his (1971). The question of whether necessary or contingent properties belong to objects absolutely or according to how the object is specified. The view that such properties are possessed absolutely by objects Linsky calls 'Aristotelian essentialism'; this view is counter to our understanding of language. Given the premise that there are nine planets, existential generalisation leads from

(3) Nine is necessarily greater than seven.

to

(4) ($\exists x$)(x is necessarily greater than seven)

Yet, if we specify this number (or a particular one of them) by 'the number of planets', the sentence

(5) The number of planets is necessarily greater than seven.

is regarded as false. It appears that certain kinds of properties are not possessed by objects simpliciter, ie. independently of language. Or at least so one could argue.

The problem is more prevalent than the discussion of necessary and contingent properties perhaps suggests. consider an example discussed by Quine (1953). Tegucigalpa is the capital of Honduras, but from

(6) Philip believes that Tegucigalpa is in Nicaragua.

we may not conclude that

(7) Philip believes that the capital of Honduras is in Nicaragua.

Does the city have or not have the property of being believed by Philip to be in Nicaragua?

We need to distinguish carefully in situation semantics between meaning and interpretation, and between meaning and information. The meaning of a sentence is a relation between discourse situations and what the sentence says in those discourse situations -- its interpretation with respect to each discourse situation. The interpretation of an utterance is a part of the information conveyed by the utterance. Following Gibson, Barwise and Perry claim that meaning and information are in the world; Dretske agrees that information exists objectively in the world, but believes meaning does not. We must examine more carefully what the concept of information amounts to in situation semantics.

We have referred to Gibson's and Dretske's ideas about information, and focused on one aspect of their conceptions -- the objectivity of information. This is basically how Barwise and Perry think of information in the early chapters of Situations and Attitudes; and is how they want us to think of information throughout the book. But this is to extend that conception of information to cover additionally information as it is normally thought of -- that is, information in a 'linguistic' or propositional sense, information as specified by means of language. I wish to make a distinction here

between what I shall call ecological information (information as conceived by Gibson) and linguistic information (information as we normally think of it, information that can easily be expressed linguistically).¹²

Barwise and Perry justify this extension of their view from ecological to linguistic information on the grounds, explicitly stated, that they want to assimilate linguistic meaning to meaning more generally (ecological meaning), and thereby assimilate linguistic information to ecological information. Essentially they want to reconceptualise linguistic information as the conventional parallel to information in Gibson's sense. The linguistic meaning of an expression, we are told, is a relation between situations in which the expression is uttered and described situations (or parts thereof, if the expression is not a sentence¹³). This relation is out there in the world, just as Gibson wanted to see his notion of information. On the other hand, Barwise and Perry also want to retain the ordinary, propositional sense of information. Linguistic information is still to be understood in the usual way, for unlike Gibson they are not defining a new notion. All this has the result of creating a tension in the way the term is used in situation semantics.¹⁴

Many theorists have sought to preserve at least some kind of parallelism, if not an isomorphism, between syntax and semantics, so that when two or more syntactic units are composed into one compound piece of syntax, on the semantic level the semantic values of these syntactic units are composed into the semantic value of the compound expression. (Montague, 1973, is a prime example.) The principle of compositionality holds that if each atomic expression is assigned a semantic value by the interpretation function, then the semantic value of compound or molecular expressions is determined by the semantic values of their constituents. However, it is generally recognised that we need to allow the syntactic rules to influence what kind of structure the corresponding semantic rules build. Barbara Partee, in a recent paper on compositionality, formulates the general principle as follows:

The meaning of an expression is a function of the meanings of its parts and of the way they are syntactically combined. (Partee, 1983, p. 1)

We are willing to tolerate semantics appealing to syntax: I shall call this 'weak compositionality'.

One claim of situation semantics is that expressions of natural language refer to things in the world -- situations, individuals, properties, and spatio-temporal locations. This claim that the interpretations of expressions are things in the world independent of language means that the operation of semantic composition must operate over parts of the real world, and this situation has implications for the precise statement of compositionality as it applies to situation semantics. Should the construction of semantic structure in situation semantics take place autonomously, without reference to the syntax for guidance in building the semantic value of the compound expression being composed? Barwise and Perry's claim that meaning is in the world entails that situation semantics should satisfy what I shall call 'strong compositionality':

The meaning (interpretation) of an expression is a function of the meanings (interpretations) of its parts.

What would be the consequences of some kind of access to syntax for semantics, if this were necessary in situation semantics, for the claimed language-independent status of the semantic entities?

If the answer to this question of whether the entities on Barwise and Perry's semantic stage have not acquired a quasi-linguistic status from the way they are actually used in the semantics turns out to be affirmative, then the original claim that situation semantics treats meaning as existing in the world independently of language will be invalidated.

I hope to show that Barwise and Perry cannot do all of semantics without allowing a kind of access to the syntactic level that confers a quasi-linguistic status upon some of the semantic entities in situation semantics. So the question then arises as to what this means for the semantic entities and for the semantics as a

whole; what is the significance of this quasi-linguistic status? If the interpretations of some kinds of expressions are not parts of the world, what are they? They are not pieces of (natural) language either, of course. Even an approach sympathetic to semantic innocence, it seems, one that sees language as talking about the world and communicating information about states of the world, must recognise that semantics cannot dispense entirely with some kind of intermediate level, a level of representation between language and the world.

These, then, are the three constellations of issues that we shall principally be concerned with in this thesis. The heart of the matter is Barwise and Perry's conviction that meaning is located in the world. The other issues are interconnected with the way in which their work develops from this basic presupposition. Attempting to locating meaning in the world requires structured interpretations for utterances of indicative sentences, whence the partiality; makes semantic innocence attractive; and necessitates a restructuring of the place of semantics within a total theory of language.

Chapter Two: Semantics and Pragmatics

2.0 Introduction

The relationship between semantics and pragmatics has been and remains the subject of considerable debate. In situation semantics it is not easy to separate the two disciplines and to see what belongs to which, for Barwise and Perry do not always clearly distinguish them, and much of what would traditionally be regarded as pragmatics seems to be incorporated into "semantics" in their theory. Thus primarily semantic problems (as they have been regarded) are solved, or perhaps dissolved, pragmatically -- particularly the propositional attitude puzzles.

There is a strong conviction that semantics deals with the truth conditional part of meaning. When natural and other efficient languages are examined, this guiding principle fails to delimit the province of semantics, for it is possible to regard semantics as having either a restricted or extensive subject matter. The distinction Barwise and Perry draw between meaning and interpretation is important for this issue, particularly as interpretations are more structured in situation semantics. The role given to information in situation semantics helps to obscure the semantics/pragmatics boundary, for information is traditionally held not to be a semantic concept (although Barwise would like to change this), yet is interwoven with the meaning of expressions.

After considering these points, I shall pursue in detail the question of exactly where in the theory truth conditions of utterances are determined. It is hoped by this method to reveal the relation between semantics and pragmatics in Barwise and Perry's theory.

2.1 Defining the relation between semantics and pragmatics

Our first task is to attempt a characterisation of semantics and pragmatics which will delimit the concerns of these branches of the study of language. The problem of just where to place the boundary between semantics and pragmatics is a difficult one, and a substantial body of thought has been given to the issue, sadly without resolving it. In his excellent book Pragmatics, Stephen Levinson devotes a considerable amount of space to discussion of this question. He adopts the division of a theory of language and language use into the three areas of syntax, semantics and pragmatics, after Charles Morris. Carnap used the term pragmatics to refer to any study of language which required explicit reference to be made to the language users. Since this reference is necessary in the case of natural language (and indeed Barwise and Perry talk of speakers and hearers more than most other theorists who would describe themselves as doing formal semantics), the Carnapian conception of pragmatics means that natural languages have only a syntax and a pragmatics -- but no semantics. If Morris' trichotomy is to be of value, we need an alternative definition of pragmatics; in particular, we need to free ourselves from being excessively influenced (as the Carnapian conception is) by the origins of model theoretic semantics and the general shape or form of the semantics of formal languages, where speakers, and language users more generally, hardly enter the picture. This is part of what Barwise and Perry have attempted to do in situation semantics.

Geoffrey Leech characterises two kinds of meaning, exemplified as follows:

(1) Donkey means 'ass'.

(2) When Miss Trotwood said Janet! Donkeys! she meant by this remark that Janet was to drive the donkeys off the lawn.

(Leech, 1974, p. 320) The sentence (1) involves "semantic meaning", while (2) involves "pragmatic meaning". Leech then depicts three

possible views of the relation between semantics and pragmatics:

- (i) Semantics subsumes pragmatics.
- (ii) Pragmatics subsumes semantics.
- (iii) Semantics and pragmatics are complementary.

The programme of generative semantics was an instance of (i), the work of Austin (1961, 1962), Grice (1957, 1975) and Searle (1969) comes under (ii),¹ but most work in formal semantics adopts the third approach.

One feature of natural languages that is crucial to the issue of where the boundary between semantics and pragmatics is located is indexicality. The occurrence of expressions like 'I', 'you' and 'this' (or their equivalents) in natural languages requires the theory to make explicit reference to speakers, hearers, and the context of utterance more generally. This means that to do semantics, which concerns the relation of language to the world, we need more material to work with than simply the sentences of the language on their own. Natural language sentences only make contact with the world when they are used; consequently our unit of analysis is not the sentence, but the utterance, usually represented by the ordered pair of sentence and context in which the sentence is considered to be spoken.

2.1.1 Two views of the province of semantics

There are two views to be taken of the province of semantics: firstly, we can see semantics as concerned exclusively with what is said when a sentence is uttered on an occasion; that is, semantics is about what is called the proposition expressed, some kind of theoretical entity that is the product of eliminating all connections with and dependence upon the context of utterance. Thus, whereas the word 'I' occurs in the sentence uttered and refers to the speaker, at the semantic level only that individual himself will be the

corresponding constituent of the proposition; the "bare" individual, not the individual qua speaker, is the constituent. In this way we obtain propositions, which are tenseless, self-contained entities, having no connection either to the particular context in which sentences can be uttered to express that proposition, or to the sentences themselves. This view of semantics, which I shall call 'narrow semantics', is concerned only with propositions -- their relations to the world and to one another, -- and emphatically not with how propositions get expressed -- the relation between sentences used to express propositions in contexts and the propositions thus expressed. The second and alternative view, which regards this other domain of relations as an integral part of semantics, I shall call 'wide semantics'.

To illustrate the difference with a specific example, consider an arbitrary singular term t in some language. With good reason we expect t to refer to an individual (modulo an occasion of use) and that individual to be its semantic value or reference. The semantics of the term t on the narrow view concerns only the fact that the designation of t, on that occasion, is the individual in question. Any other questions, such as how it designates the individual, or which individual it might designate on another occasion -- in general, how an utterance of t on an arbitrary occasion determines which individual it designates on that occasion -- are pragmatic questions, and as such are not part of semantics. Narrow semantics thus emphasises the notion of the reference of an expression. A clear exposition of this view is to be found in Richards (1974, 1976), where something is part of semantics only if it has consequences at the level of logical form.² Consider also the passage:

The pragmatic features of a sentence are those whose semantic import is determined only relative to an utterance or context of use. Indexicals, such as that and here, are among the familiar examples. Unless relativized to an utterance, a sentence containing an indexical is neither true nor false, for the indexical by itself has no definite referent and thus the sentence expresses no determinate proposition. (Richards, 1976, p.

In contrast Barwise and Perry emphasise, not the interpretation, but the linguistic meaning of an expression in their theory. Linguistic meaning, broadly construed, relates the utterance situation and the described situation. In a particular instance, the meaning of a sentence is a relation between the discourse situation d and speaker connections c , both of which are used to represent the utterance situation, and the interpretation of the sentence with respect to that d and c , the described situation.

Before we become too deeply absorbed in this issue of narrow versus wide semantics, I want to consider other aspects of the problem of separating semantics and pragmatics, to put the issue into perspective and to provide evidence on which to decide the correct view.

One way to attempt to tease apart semantics and pragmatics is to regard semantics as concerned with the truth conditional component of meaning, and all else as belonging in pragmatics. This is a very powerful criterion for drawing the boundary between semantics and pragmatics at a convenient and useful place. It cuts across the deictic/non-deictic boundary, which is just what we want. Some aspects of deixis are clearly desirable elements of semantics: the examples of indexicality mentioned briefly above (personal pronouns and demonstratives) are in this category. It is worth citing Levinson at length.

The many facets of deixis are so pervasive in natural languages, and so deeply grammaticalized, that it is hard to think of them as anything other than an essential part of semantics. If semantics is taken to include all conventional aspects of meaning, then perhaps most deictic phenomena are properly considered semantic. However, by at least some ... views ... deixis belongs within the domain of pragmatics, because it directly concerns the relationship between the structure of languages and the contexts in which they are used. But all such categorizations are theory-dependent, and on the view that we have adopted for convenience, namely that pragmatics concerns those aspects of meaning and language-structure that cannot be captured in a truth-conditional semantics, the grammatical category of deixis

will probably be found to straddle the semantics/pragmatics border. (Levinson, 1983, p. 55)

Other aspects of deixis are clearly not the sorts of things we want to have to deal with in semantics: I have in mind here such things as gestures, social and discourse deixis, and examples such as

- (3) Odysseus shouted this loud at Polyphemus as he sailed away.

where the italicised expression is itself spoken loudly to indicate how loudly Odysseus is asserted to have shouted. (See Levinson, 1983, p. 95) Citing Fillmore (1975), Levinson says that social deixis concerns 'that aspect of sentences which reflect or establish or are determined by certain realities of the social situation in which the speech act occurs' (p. 89), but decides to consider only 'those aspects of language structure that encode the social identities of participants (properly, incumbents of participant-roles), or the social relationship between them, or between one of them and persons and entities referred to.' (p. 89) Discourse deixis, to be distinguished from anaphoric reference, is reference to a linguistic expression or a text of discourse itself, by means of 'but', 'however', 'besides', 'to the contrary', and other expressions.

The value of Morris' trichotomy lies in preventing us from compelling all the phenomena having to do with meaning into a single level of our theory, and instead allowing their division between semantics and pragmatics, in effect distinguishing "semantic meaning" from "pragmatic meaning". This is a point that Levinson makes particularly well in relation to the notion and theory of implicature: the separation contemplated allows us to unload into pragmatics numerous phenomena and shades of meaning that would otherwise only complicate the semantics to the point of making it obscure and useless. By locating treatment of these phenomena in pragmatics we are left with the core meaning of expressions in semantics, thus having the opportunity to construct a framework for this core or skeletal meaning, upon which to hang the more flexible pragmatic meanings expressions can have on occasions.

Now from this set of dilemmas [the multiplicity of pragmatic meanings] the notion of implicature offers a way out, for it allows one to claim that natural language expressions do tend to have simple, stable and unitary senses (in many cases anyway), but that this stable semantics core often has an unstable, context-specific pragmatic overlay -- namely a set of implicatures. (Levinson, 1983, p. 99)

Of relevance to this issue of narrow or wide semantics is the interesting debate between Hartry Field (1972) and John McDowell (1978) on the status of Tarskian truth theories. Field argues that Tarski did not reduce the notion of truth to physicalistically acceptable concepts; rather, he reduced the notion to that of primitive denotation, or primitive reference -- terms Field uses to cover the three notions of what it is for a term to designate an object, a predicate to be satisfied by, or apply to objects, and a function symbol to be fulfilled by a pair of objects. For Field, there remains a certain kind of work to be done to make truth physicalistically acceptable -- work towards which he sees Kripke's efforts on a causal theory of names as contributing. (Notably, Kripke's work is about how a name designates its referent.)

Field draws an interesting parallel with the concept of valence in chemistry, and its reduction to physical concepts. The point is that if this reduction were achieved only in the manner of (3), it would not be a real reduction at all.

- (4) $(\forall \underline{E})(\forall \underline{n})(\underline{E} \text{ has valence } \underline{n} \equiv \underline{E} \text{ is potassium and } \underline{n} \text{ is } +1, \text{ or } \dots \text{ or } \underline{E} \text{ is sulphur and } \underline{n} \text{ is } -2)$

The corresponding "reduction" for primitive denotation would take the form:

- (5) $(\forall \underline{e})(\forall \underline{a})(\underline{e} \text{ is a name that designates } \underline{a} \equiv (\underline{e} \text{ is 'c}_1 \text{' and } \underline{a} \text{ is } \underline{c}_1) \text{ or } (\underline{e} \text{ is 'c}_2 \text{' and } \underline{a} \text{ is } \underline{c}_2) \text{ or } \dots)$

(Here \underline{c}_j is the translation of the name ' c_j ' in the object language into the metalanguage (English). There are similar formulae for predicate and function symbols.) Mere extensional equivalence of the left hand side with the right hand side is not sufficient for real

reduction; we require a theory that not only relates e and a, but that has some explanatory value with respect to that relation. Tarski's definition leaves this relationship as mysterious as ever, because, like narrow semantics, it simply states the bare fact that the designation of e is a, or more precisely, that the pair $\langle e, a \rangle$ satisfies the designation relation.

Narrow semantics has the form (5): it merely states, for example, that a term t designates (on the occasion in question) an individual a, and regards semantics as not involved with questions such as how it is that t designates a, or what t might designate on another occasion. However, to be content with a narrow theory is to have low standards for semantics, as Putnam summarises Field's argument (Putnam, 1976, p. 15). (3) is not a satisfying explanation of the concept of valence in physical terms -- we have some sense of an explanatory reduction that goes beyond extensional equivalence, and we are not satisfied by a theory which does not provide such an explanation. The same requirement applies, or should apply, Field argues, to semantics. Either a semantic theory must explain primitive reference, or it must have a good reason why it does not.

Michael Devitt holds a similar view (Devitt, 1974, 1981); indeed, Devitt acknowledges the influence of Field's article on his own thinking). For Devitt, the main problem in semantics is to explain the semantic notions that occur in a semantic theory: truth and reference (meaning can be explained in terms of these two, Devitt says). A theory would have three parts: (i) a generative grammar to relate indicative sentences to base sentences; (ii) a Tarski-Field truth theory to deliver the truth conditions of the base sentences; (iii) an explanatory theory of primitive reference. Devitt regards his own work on designation as part of (iii).

McDowell disagrees with Field as to how semantics and physics are related: Field thinks that semantics and physics are related at the level of primitive reference, that is, at the level of the axioms of the truth characterisation. McDowell tears apart the level at which language is related to the world within the semantic theory (namely, at the level of the axioms or of primitive reference) and

the level at which the semantic theory itself is primarily connected to the physical facts upon which its acceptability depends (namely, at the level of the theorems, the level at which the truth theory is holistically compared with the physical facts). The physical facts, for McDowell, are: (a) the structural properties of physical utterance-events which permit the language to be given a syntactic description; and (b) the complex relations between behaviour and environment which permit (some of) the behaviour to be described and understood in intentional terms.

McDowell points out that the acceptability of a proposed truth characterisation depends on its meshing suitably with the hard physical facts. This mesh must be achieved while at the same time satisfying two requirements: (i) parts of utterances must contribute systematically to the content of the whole; and (ii) the truth characterisation should be psychologically adequate, that is, it should make behaviour intelligible.

A proposed truth theory for the language should recursively characterise as true all true sentences in the language through entailing suitable theorems. The acceptability of a theory is judged, holistically, on how well all of its theorems mesh with the physical facts that it has to explain and account for. Field believes we can question the underpinings of the mesh; McDowell takes the view that there need be no underpinning to the mesh: if the theory were such that it did not fit with the physical facts, we would simply reject the theory.

The views of Field and McDowell are concerned with the status of primitive denotation: are there real relations of this kind there in the world, or not? If Field is right, and we develop a theory of primitive denotation, then wide semantics would dominate the field; if McDowell is right, narrow semantics will probably predominate.

2.1.2 Stalnaker's scheme

Stalnaker (1972) tackles this problem of dividing semantics

from pragmatics. On the one hand, Stalnaker attempts to make a clear distinction between semantics and pragmatics: at the abstract level there is a definition of each: 'Semantics studies propositions. Pragmatics is the study of linguistic acts and the contexts in which they are performed.' (Stalnaker, 1972, p. 383) Yet in practice it is not always easy to separate them out. Propositions, which Stalnaker regards as the subject matter of semantics, are entities independent of the language(s) whose sentences can be used to express them; as Stalnaker realises, semantics, on this narrow conception, 'has no essential connection with language at all, either natural or artificial.' (p. 382) Like Carnap's conception of the respective provinces of semantics and pragmatics, this is neither useful nor intuitively satisfactory; still, Stalnaker does say:

Though one may study propositions apart from language, accounting for the relation between language and propositions still falls partly within the domain of semantics. One of the jobs of natural language is to express propositions, and it is a semantical problem to specify the rules for matching up sentences of a natural language with the propositions that they express. In most cases, however, the rules will not match sentences directly with propositions, but will match sentences with propositions relative to features of the context in which the sentence is used. These contextual features are a part of the subject matter of pragmatics ... (Stalnaker, 1972, p. 383)

This passage suggests that Stalnaker himself espouses a version of wide semantics, for he sees the specification of rules that match sentences of a language with propositions expressed as partly within semantics.

A scheme similar to that Stalnaker envisages is formalised in Kaplan's (1979) *Logic of Demonstratives*. For Stalnaker, an interpreted sentence, the output of the syntax and semantics and the correlate of Kaplan's character, together with certain aspects of the context determines a proposition; in turn the proposition (Kaplan's content) together with a possible world determines a truth value. This scheme underlies Stalnaker's conception of the relation between language and the world: the problem of what is semantics and what

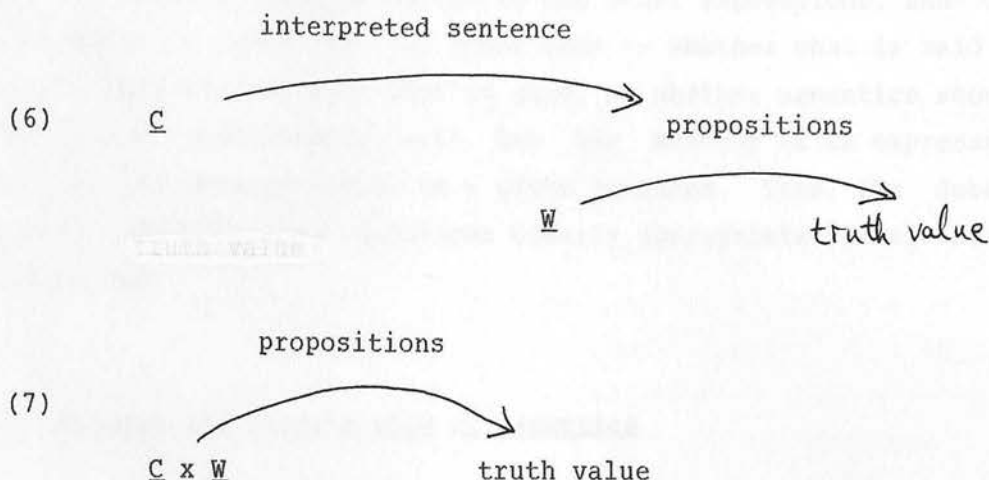
pragmatics, is not to draw a line somewhere such that semantics is what lies on one side of the line and pragmatics is what lies on the other side. For example, we might be tempted, especially given the history of the subject, to say that getting from contexts to propositions is part of pragmatics, but that getting from propositions to truth values is part of semantics. Rather, to understand the remarks Stalnaker has made, we must see this scheme as underlying the total theory, and semantics and pragmatics as approaching it asking different questions.

Semantics is essentially truth conditional for Stalnaker, and hence semantics must make reference to contexts as well, for some aspects of the context can be determinants of truth value. In the past, too, theories in formal semantics have sometimes made reference to contextual facts or coordinates (Kamp, 1971, and most notably Kaplan, 1977, 1979). For Stalnaker, two questions are asked at the semantic level: (a) Which proposition was expressed? and (b) What is the world like? ie. is the proposition true? Both of the areas or tasks sketched in the previous paragraph are therefore in the domain of semantics.

At the pragmatic level there are also two questions to be asked, according to Stalnaker's analysis: (a) What are the interesting types of speech acts and speech products? and (b) Which features of the speech context help determine which proposition is expressed when a given sentence is uttered? Whereas semantics is concerned with how the various parameters of the context may be determinants of truth conditions, pragmatics is concerned to explicate the relation of these parameters to each other and to identifiable features of linguistic contexts. Hence, although both semantics and pragmatics are dealing with the same subject matter to some extent, and both are operating within the same scheme or conception of how language functions, they are asking different questions about it.

Much of Stalnaker's article is aimed at defending his basic conception of the relation of language to the world (the scheme sketched above) against a rival scheme which combines the two steps

into one. The two schemes may be set out diagrammatically:



In the diagrams C is the set of contexts and W the set of possible worlds. We shall not consider Stalnaker's arguments for (6); instead I want to point out that (6) seems to foster the growth of a narrow view of semantics more than (7). Although Stalnaker himself, who accepts (6), does not do this, it is easy to regard the first step in (6), from contexts to propositions, as part of pragmatics and only the second step as semantics. The scheme (7), though formally equivalent to (6) -- since (6) is a version of (7) in which the function has been curried, -- does not lend itself so easily to that interpretation of the formal apparatus.

In case the reader is worried that these points lack relevance to situation semantics as the discussion is couched in the possible worlds framework, he should recognise that the abstract points are relevant, notwithstanding the differences in the formal theories (and by considering partial possible worlds instead of total worlds, he can make the possible worlds formalism more like the situation semantics formalism³). The context c corresponds to the discourse situation and speaker connections; propositions correspond to the interpretations of sentences uttered at those situations; and the conception of the interpretation as a class of abstract situations is formally equivalent to the conception of it as a function from abstract situations to a truth value. Recast in situation semantics terminology, the discussion about where to place the boundary between

semantics and pragmatics is about whether semantics is concerned just with the interpretations of sentences and other expressions, and the things that we want to say about them -- whether what is said is true, and what follows from what is said; or whether semantics should be concerned additionally with how the meaning of an expression determines its interpretation on a given occasion. Thus, the debate recounted above raises questions clearly appropriate for situation semantics too.

2.1.3 Barwise and Perry's view of semantics

We may represent the two views of narrow and wide semantics, which deal with the question of where to draw the boundary between semantics and pragmatics, in the following manner. Semantics, it is agreed, is the study of the relation of language to the world. The narrow semantic view, rooted in the origins of model theoretic semantics where the object language is a formal language, crucially non-indexical and where speakers do not enter the picture, begins by seeing the domain, or province, of semantics as the mapping of expressions of a language to the world. Its concern is getting from a particular expression to its reference, which is something in the world. Thus the focus of the narrow view is, admirably, getting from the linguistic to the non-linguistic. However, the domain of this mapping can be the expressions of a language only when those expressions always determine the same semantic content, irrespective of when, how or by whom they are used, for it is always the level of semantic content that is actually related to the world in a theory. If the expressions are indexical in any way, then the domain of the mapping must be the semantic contents expressions have on particular occasions of use. With many of the simpler languages in logic, the expressions determine a unique semantic content so that the domain can straightforwardly be the expressions themselves. When attention was focused on natural language and the prevalence of indexicality inherent in so many natural language expressions was realised, emphasis had to be laid on the semantic content of expressions on

occasions of use, and not on expressions themselves. In summary, narrow semantics is really concerned only with the relation of fixed semantic content to the world.

Barwise and Perry, on the other hand, have been much impressed with the extent to which natural language possesses the property, which they call efficiency, that an expression can be used on different occasions to express different things -- its semantic content varies with occasion of use. So impressed are they, that they see this as a major aspect of natural language that must be given a central position. Consider the following passages from their book, taken from chapter two, which is entitled 'Evidence for a Theory of Linguistic Meaning':

In this chapter we argue that there is much more evidence than just entailments for which a semantic theory must account, evidence that in fact causes us to look with some scepticism on the very idea of entailments between sentences. The evidence consists of insights of philosophers of language and linguists into the way natural languages work. We call these insights six semantic universals of human languages. Most of these universals are at odds with assumptions built into standard model theory. We take these phenomena as central to an adequate semantic theory, not just minor headaches to be explained by amending the semantics of first-order logic, a theory that evolved before their ubiquity was recognized. (S&A, p. 28)

[...] what is important, after all, is the fact that expressions, whether simple or complex, can be recycled, can be used over and over again in different ways, places and times, and by different people, to say different things. This is what we mean by the efficiency of language. (p. 32)

The dependence of the interpretation of an utterance on facts about the discourse situation is usually referred to as indexicality. For historical reasons, it is often suggested that indexicality is not really a semantic phenomenon but belongs instead to the "pragmatic" side of language use. [...] Indexicality is extremely important to the information-carrying capacity of language. (pp. 33, 34)

Unfortunately, Barwise and Perry do not say very much more explicitly about why they think indexicality should be regarded as part of

semantics instead of as part of pragmatics. However, they regard indexicality both as one source of the efficiency of natural language and as having a crucial role in the communication of information.

Barwise and Perry want to include some traditionally pragmatic factors in the semantics because of their conception of the role of language: the primary use of language is to convey information about the world. Thus, if semantics, the study of the relation between language and the world, is to be concerned with anything, it should be concerned with this information-communicating function of language. Since much of the information communicated by an utterance has to do with who the speaker is, the time and place of utterance, and so on -- that is, it is inverse information -- semantics should be concerned with these things. All this can be handled, they believe, by a relational view of meaning, which relates the expression used in an utterance situation with the interpretation it has there. Linguistic meaning must be an integral part of semantics. Semantics is more than interpretations and situation structures (models); it must provide the framework or backbone around which information, including inverse information, can be organised.

As the title of their second chapter indicates, Barwise and Perry want to specify just what the evidence is that the theory must explain and account for. This task is especially important for them, because they want to say that there is much more evidence than the narrow view allows. I have already outlined the sorts of things that this approach to semantics is interested in -- not just the interpretation of an expression (on an occasion), but all the factors involved in linguistic meaning, as this notion is understood in situation semantics. And it is clear that Barwise and Perry see all of this as within the province of semantics; for their second chapter begins: 'Semantics is the study of linguistic meaning, of the relationships that hold between expressions of language and things in the world.' (S&A, p. 27)

If Barwise and Perry have adopted the enlarged view of the province of semantics, and I believe that they have, then they have done so because of the principal place they give to the concept of

information in language use and the consequent upheaval in semantics. This enlarged conception of semantics -- wide semantics -- is not concerned only with getting from an expression, or a semantic content, to the world, but also with going the other way, back to the expression used. Importance is given to locating a speaker in a context of utterance because attention must be paid to how what is said is determined jointly by the context of utterance and the sentence uttered. In situation semantics terms, we are concerned with the relation between the discourse situation and the interpretation, as well as obtaining the truth value from the interpretation.

It is interesting to remember at this point that David Kaplan sees his distinction between the character of an expression and its content (on an occasion of use) as an extension of Frege's theory of sense (Kaplan, 1979, p. 83), and it would therefore appear that both of these notions are part of semantics. Kaplan remarks that the distinction 'was unlikely to be noticed before demonstratives came under consideration, because demonstrative-free expressions have a constant character' (p. 85). Treatments of indexicality today tend to include it within semantics. We are reminded again, as Barwise and Perry also point out, that we should be careful before applying a concept of what semantics is, developed in the study of logical calculi and mathematical languages, to natural languages, which contain demonstratives and indexicals.

Another indication that Kaplan sees character as an integral part of semantics, is his assertion, in the context of comparing his distinction with Kripke's distinction between the a-priori and the necessary, that his (ie. Kaplan's) distinction between character and content 'lies more purely within logic and semantics' (Kaplan, 1979, p. 85). In view of the similarities between Kaplanian character and meaning in situation semantics, Kaplan, I take it, espouses the wide view of semantics.

More recently Barwise has come to include in semantics, in a more radical way, all the information an utterance of a sentence can convey. In a recent paper he writes:

In our book, Perry and I concentrate on what the utterance means about the described situation, because we are primarily interested in the straightforward use of language to convey information. Thus, we identify the linguistic meaning of declarative sentences with the specific constraint that holds between utterances of the sentence and situations described by such utterances. By picking out one constraint, the one that holds between the types of utterances of sentence (7) [(3) = 'It's 4 p.m.] and the types of situations it describes, and calling that the linguistic meaning of (7), we are betraying the fact that our primary concern is for the subject matter of the sentence, for finding out what it is talking about and what it is saying about that subject matter. (Barwise, 1983b, pp. 24,25)

From this passage, it seems that Barwise wants to set that entity which in the book is the interpretation, namely what the expression denotes, on a par with all the other sources of information for the listener.

Barwise and Perry have unfortunately not argued convincingly that information should be regarded as having a place in their semantics. They are surely free to adopt an information-based approach to the philosophy of language more generally; but the issue is whether that part of their theory that deals with information is properly semantics, or should rather be regarded as pragmatics. Do they offer us a semantic theory, or a general theory of language? Is their approach situation semantics or situation pragmatics-semantics?

We must be careful not to let this point degenerate into a terminological disagreement: instead of taking issue with the terms 'semantics' and 'pragmatics', we must penetrate behind these labels to the theoretical areas they are used to denote and ask how these areas are related and which tasks are performed where. For example, we can ask whether the informational part of the theory is something that should be invoked to solve traditional problems such as the failure of the principle of substitutivity of coreferential terms in propositional attitude contexts. The difficulties in explaining this failure of substitution have created a pressure to which some theorists have responded by challenging our intuitive judgements (eg. Ralph does believe that the man seen at the beach is a spy), and others by seeking an "epistemological" solution (eg. Hintikka, 1969a,

1969b; Partee, 1979; Saarinen, 1982). Barwise and Perry's approach, which at least raises new questions about how our total theory of language confronts the data, is, I think, an interesting variant from this perspective.⁴

2.2 The determination of truth conditions

In this section I shall examine the structural relations between semantics and pragmatics as found in Barwise and Perry's theory, where the concept of information is given a central place. My central concern in this section is the relationship between information and semantics; in particular, I shall concentrate on how information and the interpretation are each related to the truth conditions of an utterance. The expressions that I shall look at are names and definite descriptions.

First, to put what follows in perspective, it should be said that Barwise and Perry do provide situation semantics with a model or structure of situations: a structure is a pair $\mathcal{M} = \langle \mathbb{M}, \mathbb{M}_0 \rangle$ of factual and actual situations. An utterance is true in \mathcal{M} if its interpretation contains an actual situation:

$$\mathcal{M} \models_{d,c} \varphi \text{ iff } (\exists e)(e \in \mathbb{M}_0 \ \& \ e \in_{d,c} \llbracket \varphi \rrbracket).$$

In the sequel we investigate whether this truth definition applies universally.

2.2.1 Information and truth conditions: a puzzle

To begin with, consider the following paragraph, in which Barwise and Perry say some interesting things about the relationship between information, interpretation and truth conditions:

The name used is often crucial to the information that is intended to be conveyed. Suppose Jim walks up to Melanie

and says, "I'm Jim", intending to "tell her his name". The interpretation of this will be trivially actual, the course of events in which Jim is Jim. What Melanie will learn is that the person speaking to her is called "Jim". This is part of the truth condition of the utterance, and the information made available to Melanie, although it is not part of the interpretation of the utterance. (S&A, p. 264; emphasis added)

Jim utters the sentence 'I'm Jim', and this sentence, as uttered on that occasion, has a certain interpretation. Not to be confused with the interpretation is that which Melanie learns as a result of hearing and understanding the utterance -- the information that is available, and which Melanie will pick up, provided she is not daydreaming or otherwise not paying attention. Barwise and Perry have taken considerable care to point out that the information that is conveyed by an utterance is distinct from, and often very different from, the interpretation of the utterance: interpretation underdetermines information. Indeed, they have emphasised this point by speaking of the fallacy of misplaced information, the error of those views which locate all the information in the semantic value of the uttered sentence.

What are the consequences of their approach for the relation between truth conditions and interpretation? From what they say in the passage above, Barwise and Perry appear to be shifting the determination of the truth conditions on utterances away from the exclusive control of interpretations of those utterances in conjunction with the model (or situation structure, as it is called). Thus: '[That the person speaking to Melanie is called 'Jim'] is part of the truth conditions of the utterance, ... although it is not part of the interpretation of the utterance.' If Barwise and Perry really mean what they say in this passage, then some radical revision or restructuring of semantic theory is being carried out; but is this possible? Can they really do this?

The interpretation of Jim's utterance is quite simply that Jim is Jim; more formally, it is the class of all those (abstract) situations in which, at the discourse location l_d , the identity relation is said to hold between Jim and Jim.

In e : at \underline{d} : identical, Jim, Jim; yes

Now, although in developing situation semantics, Barwise and Perry have given it a general structure different from the usual model theoretic accounts of semantics, it is supposed to be still the case that the truth or falsity of an utterance is determined with respect to a model or situation structure. Indeed, this is what happens, or should happen, according to the formal semantic definitions Barwise and Perry have given at one point in the book (S&A, pp. 60,61). A sentence φ , uttered in a discourse situation \underline{d} with speaker connections \underline{c} , is true in the situation structure $\mathcal{M} = \langle \underline{M}, \underline{M}_0 \rangle$ iff there is a situation $\underline{e} \in \underline{M}_0$ such that $\underline{e} \in \underline{d}, \underline{c} \llbracket \varphi \rrbracket$. According to this understanding of situation semantics, the truth conditions of a sentence as uttered on a particular occasion \underline{d} with certain connections \underline{c} , are semantically determined relative to a situation structure, via the interpretation $\underline{d}, \underline{c} \llbracket \varphi \rrbracket$ of the sentence. Contrary to this, however, in the passage cited above, it appears that the truth conditions of Jim's utterance are determined to some extent independently of the interpretation and situation structure: it is explicitly stated there that the truth conditions involve the requirement that the person speaking to Melanie be called 'Jim', something which is not part of the interpretation.

If what has been sketched out here is true, Barwise and Perry have a puzzle right at the heart of their semantics. Truth conditions are universally regarded as very much part of semantics; however, it would seem that the concept of meaning in situation semantics, and the consequent role of inverse information, result in truth conditions being pulled away from that part of the theory which involves interpretations and the situation structure. Yet this seems to be precisely what they are suggesting in this passage, and it is connected with the whole structure of their semantics as developed in the book, with its emphasis on information.

2.2.2 Names and inverse information

When Barwise and Perry define the semantics of names, they say that the simplest definition would be to consider the meaning of a name β as a relation between β and the individuals it can be used to name:

$$\underline{d}, \underline{c} \llbracket \beta \rrbracket \underline{a}_\sigma, \underline{e} \text{ iff } \underline{c}(\beta) = \underline{a}_\sigma. \text{ (S\&A, p. 131)}^5$$

They go on to say that this simple definition is unsatisfactory, because part of the (inverse) information that we can pick up from the utterance of a name is that the bearer has the property of being a β , and they want to build this into the semantics of names. Thus, when they return to complete their account of names later in the book, an account which takes notice of the role information plays in communication, they suggest the following definition:

$$\begin{aligned} \underline{d}, \underline{c} \llbracket \beta \rrbracket \underline{a}_\sigma, \underline{e} \text{ iff } & (1) \underline{c}(\beta) = \underline{a}_\sigma, \text{ and} \\ & (2) \underline{a}_\sigma \text{ is a } \beta. \text{ (p. 167)} \end{aligned}$$

The second condition is actually spelled out in terms of the speaker having the information that \underline{a}_σ is a β , that is, that the individual to whom he refers has the name he uses. The final specification looks like this:

$$\begin{aligned} \underline{d}, \underline{c} \llbracket \beta \rrbracket \underline{a}_\sigma, \underline{e} \text{ iff } & (1) \underline{c}(\beta) = \underline{a}_\sigma, \text{ and} \\ & (2) \text{ in } \underline{d}: \text{ at } \underline{l}_d: \underline{\text{inf}}, \underline{a}_d, \underline{E}; \text{ yes} \\ & \text{ of, } \underline{b}, \underline{a}_\sigma; \text{ yes} \end{aligned}$$

where $\underline{\text{inf}}$ stands for the relation of having the information that, and $\underline{E} := \text{at } \underline{l}: \text{being-a-}\beta, \underline{b}; \text{yes}$ (p. 168).

We shall use this semantics for names to look at Jim's utterance of 'I'm Jim' in the above scenario in more detail than we have so far. Let us suppose that \underline{d} and \underline{c} are respectively the discourse situation and the speaker connections associated with the utterance, and let us write ' \underline{j} ' for Jim himself. Jim's utterance of 'Jim' (as part of his utterance of 'I'm Jim') refers to \underline{j} iff $\underline{d}, \underline{c} \llbracket \text{Jim} \rrbracket \underline{j}, \underline{e}$, where

$e := \text{at } l_d: \text{identical, } j, j; \text{yes.}^6$

That Jim is called 'Jim' is not part of the interpretation, and thus cannot be a factor in the determination of the truth or falsity of Jim's utterance solely from its interpretation and a situation structure \mathcal{M} in the way defined in situation semantics. On the other hand, the truth conditions of the utterance, as understood informally, do involve Jim's being called 'Jim' (his utterance of 'I'm Jim' would be false if he were not a Jim), and this is borne out by the semantics of names, as it should be. If he were not called 'Jim', neither Jim nor anyone else could have the information that he were, no matter how much they were convinced of it. This requirement acts on the derivation of j as the referent for 'Jim' or, to put the point in accordance with a less dynamic conception of the relation between meaning and interpretation, we may regard the requirement as an integral part of the meaning of the name, constraining those entities among which the relation of meaning holds.

In determining truth conditions, should we, in innocent semantics, be allowed to look at the utterance and take account of the expressions used?⁷ It is not surprising that the information content of an utterance should be sensitive to the expressions used, but ought the truth conditions in innocent semantics to be sensitive in this way? We shall return to this point to clarify our understanding of just what is going on in this matter; but first we shall look at how another type of expression fares.

2.2.3 Referential uses of definite descriptions

The same problem arises with the referential use of definite descriptions, since the definition of meaning for definite descriptions allows the same pulling apart of truth conditions from interpretation. The semantics for a definite description is:

$d, c \models [\text{the } \kappa] \mid a_f, e$

iff $d, c \models [\kappa] \mid a_g, e$

and there is at most one \underline{b} such that $\underline{d}, \underline{c} \models [\pi] \mid \underline{b}, \underline{e}$. (p. 149)⁸

The meaning of the description 'the π ' is a relation between \underline{d} , \underline{c} , an individual \underline{a}_π and a course of events \underline{e} , the resource situation. When the description is used referentially, the resource situation, \underline{e}_r say, is being used to identify an individual who then becomes part of the interpretation of the utterance. The same problem arises as with names because the individual denoted by a definite description used referentially to the interpretation of the smallest sentence containing the description must possess, in the resource situation, those properties according to which the description picks it out. (This condition is analogous to the requirement that the individual have the name used.)

As an example, let us look at a sentence Barwise and Perry use to illustrate their theory of descriptions, 'The man in a red vest is a fool'. Let us suppose that I utter the sentence in an utterance situation $\underline{d}, \underline{c}$ and let the resource situation be $\underline{e}_r = \underline{c}$ ('the man in a red vest'). Further, let the description pick out the individual $\underline{m} = \underline{d}, \underline{c} \models [\text{the man in a red vest}] \mid (\underline{e}_r)$. Then we have:

$$\underline{d}, \underline{c} \models [\text{'the man in a red vest'}] \mid \underline{m}, \underline{e}_r.$$

Let \underline{e}_0 be an arbitrary situation in the interpretation of the utterance:

$$\underline{d}, \underline{c} \models [\text{'the man in a red vest is a fool'}] \mid \underline{e}_0.$$

Now \underline{e}_0 may specify that a number of things are the case, but we must at least have that in \underline{e}_0 at the discourse location \underline{l}_d , the property of being a fool is predicated of the individual \underline{m} .

In \underline{e}_0 : at \underline{l}_d : fool, \underline{m} ; yes.

As Barwise and Perry themselves emphasise, only the individual \underline{m} himself is part of the interpretation of the utterance, and hence really only \underline{m} is relevant to a determination of the truth conditions of the utterance as calculated by whether the interpretation, as a class of situations, contains an actual situation.

However, in conflict with this is the fact that, in situation semantics, for \underline{m} to be a man in a red vest (in \underline{e}_r) is crucial to the truth conditions of the utterance, just as that Jim is called 'Jim' was crucial in the previous example. Firstly, according to Barwise and Perry, a description cannot pick out an individual unless that individual satisfies the describing conditions.

Definite descriptions can be used to identify an object by the properties he, she or it has in some situation. That is, they exploit what is going on in one situation to identify an object. One situation, what we call a resource situation, is exploited. In order to serve as a resource situation for a definite description, a situation must have an object satisfying the defining condition. (S&A, p. 146)

So \underline{m} must be a man in a red vest in \underline{e}_r if my utterance of the description is to pick him out. But even more appropriately, Barwise and Perry claim that if this condition is not fulfilled, then the utterance cannot be true -- hence it is false:⁹

The situation down the road is constrained by my utterance to have such a man in it, however; only if it does, can my utterance turn out to be true. (S&A, p. 154)

This case is perhaps not so strong as the previous one involving Jim and Melanie; there it is clear that if Jim is not called 'Jim', his utterance is false. With descriptions, however, it has been said that although \underline{m} is not a man in a red vest in \underline{e}_r , in certain circumstances my utterance is nonetheless true, or at least is not clearly false. After all, did not Donnellan (1966) show us that one can refer to something by means of a definite description which is not satisfied (Donnellan's 'referential' use of descriptions, not to be confused with Barwise and Perry's use of 'referential')?

Suppose the throne is occupied by a man I firmly believe to be not the king, but a usurper. Imagine also that his followers as firmly believe that he is the king. Suppose I wish to see this man. I might say to his minions, "Is the king in his counting house?" I succeed in referring to the man I wish to refer to without myself believing

that he fits the description. It is not even necessary, moreover, to believe that his followers believe him to be the king. If they are cynical about the whole thing, know he is not the king, I may still succeed in referring to the man I wish to refer to. Similarly, neither I nor the people I speak to may suppose that anyone is the king and, finally, each party may know that the other does not so suppose and yet the reference may go through. (Donnellan, 1966, p. 52)

Donnellan's view is that in some such cases we may suppose that the speaker has referred to some individual, and predicated something of that person; whether this de re attribution of a property is true or false is something that is objectively determinable, and hence the utterance is either true or false, depending on whether the individual has or has not the property.

However, Barwise and Perry have altered the semantics of definite descriptions, so that the utterance cannot be true unless the individual referred to satisfies the describing conditions in some situation. With referential uses, or value-laden uses as I shall call them to distinguish them from Donnellan's referential uses, this situation is the resource situation. Just as with names, there are conditions on the referent of the definite description which do not end up as part of the interpretation, and hence the same puzzle arises.

Finally, before returning to the central issue, let us look at what happens when the identity of the referent is problematical. Whenever a value-laden use of the description 'the man in a red vest' does not pick out a (unique) referent, this may be because there is in e_r more than one b such that $d, c \llbracket \text{'the man in a red vest'} \rrbracket b, e_r$, or because there is no b such that $d, c \llbracket \text{'the man in a red vest'} \rrbracket b, e_r$. In both cases there is no individual donated to the interpretation of the smallest containing sentence, and we are left with the problem of what to say about the utterance: is it false, neither true nor false, or perhaps infelicitous? Is there still a semantic problem, or not?

Donnellan's influential article (Donnellan, 1966) claimed that definite descriptions could be used referentially, simply as a means of enabling one's audience to pick out who or what one was talking

about.

Where the definite description is simply a means of identifying the person we want to talk about, it is quite possible for the correct identification to be made even though no one fits the description we used. (Donnellan, 1966, p. 47)

Consider also Donnellan's celebrated example of the person who asks at a party, 'Who is the man drinking a martini?' That there is only water in the man's glass does not preclude the questioner's having referred to the man and asked who he is. When the speaker intends to refer to a particular individual, but uses a definite description which the individual does not uniquely satisfy, Donnellan's view is that (in most cases) the speaker clearly refers to that individual and predicates something of him.¹⁰

In contrast to this, in the case of a name uttered falsely, our reaction is clear. Suppose the person, *j*, who walks up to Melanie and says, 'I'm Jim' is not called 'Jim', but 'John'. We have the same semantic problem in this case as with the description: we are looking for a referent for 'Jim' with which to construct the interpretation; 'I' will denote John, but who does 'Jim' denote? The contribution of this utterance of 'Jim' seems intuitively to be a Jim (but which Jim?); at any rate we do not hesitate to say that John's utterance is false. Whereas there is a formal parallelism in the semantics for names and referential uses of definite descriptions in so far as both impose a condition that is not reflected at the level of the interpretation, on an informal level this parallelism is lacking: in the case of names, our intuitions are clear that the utterance is false if the condition is not met, but we are not so sure what to say, in the case of descriptions.¹¹

2.2.4 Which factors determine truth conditions?

My main concern is the location, or locations, where work is done in determining truth conditions, and the possibility of a

discrepancy between our intuitive judgement of the truth conditions of an utterance on the one hand, and the truth conditions as determined by the interpretation of the utterance in conjunction with the model on the other. Barwise and Perry's definition of the meaning of names reflects aspects of our informal judgement of truth conditions, which, however, do not show up in the interpretation. I have said that this at least raises the question of whether Barwise and Perry are transferring the location where truth conditions are determined from the central semantic part of their theory to pragmatics.

However, one might argue that, although inverse information such as Jim's being called 'Jim' is not part of the interpretation, it is not totally unconnected with the interpretation either, for the following reason. If Jim were not called 'Jim', then, given the semantics for names that Barwise and Perry define, how could the interpretation of Jim's utterance 'I'm Jim' be that Jim is Jim? The name has to contribute an individual to the interpretation, and that individual could not be Jim himself, if he were not thus named. Thus, does not the interpretation contain some information about which expression was used, if only in this rather tenuous and fragile way? We might say that the interpretation contains a fossil of the name.

Yet this cannot be exactly right. There are numerous ways to designate Jim: using demonstratives, pronouns, and descriptions, all of which would contribute Jim to the interpretation of the smallest sentence containing the expression used, and the interpretation does not distinguish between them: there are no traces, no fossils, of which one of these many possible expressions was used.

To continue our inquiry, let us ask how Barwise and Perry envisage the various factors determining the truth conditions. Consider the following interesting passage:

When Joe says 'Jackie is biting Molly', the situations in the interpretation of his utterance all have Jackie biting Molly, but they don't all have Jackie being a Jackie, and Molly being a Molly. Some of them may have

Jackie named 'Molly' and Molly named 'Jackie'. If they were actual, what Joe said would be true, but to say it he would have had to say 'Molly is biting Jackie'. (S&A, p. 166; emphasis added)

According to this passage, which occurs in the same section as their final definition of the meaning of names, Joe can utter the sentence 'Jackie is biting Molly' and refer to situations in which Jackie is not called 'Jackie', i.e. such situations are members of the interpretation of the utterance. How is this possible, if Jackie must be a Jackie in order to be the referent of the name 'Jackie'? If Jackie is a Jackie, then the utterance of 'Jackie' designates the individual Jackie, and this individual goes to build up the interpretation of the whole utterance, but, quite simply, the fact that Jackie is a Jackie is not part of that interpretation. So, even situations in which Jackie explicitly has another name can be part of the interpretation. Thus the interpretation of an utterance of 'Jackie is barking' would contain

$e :=$ at \underline{l} : barking, \underline{j} ; yes

name-of, \underline{j} , 'Molly'; yes

where $\underline{l} = \underline{c}(\text{is})$. However, none of these situations in which Jackie is not a Jackie can be factual. Although they are in the interpretation, the interpretation is just this particular class of courses of events, only because Jackie is actually called 'Jackie'.

A statement is true if the interpretation contains an actual situation. Since none of these situations in which Jackie is not a Jackie, can be factual, they make no difference to truth conditions. If the interpretation contains an actual situation, the utterance is true; if it does not, that these strange situations are also included in the interpretation cannot add an actual situation to the interpretation, and the utterance is false.

But there is another twist to come. Nothing Barwise and Perry have said prohibits non-factual discourse situations and speaker connections being involved in meaning. Suppose \underline{d} is a non-factual discourse situation and \underline{c} non-factual speaker connections, and suppose further that a name Psyche uttered in $\underline{d}, \underline{c}$ refers to Jackie,

although Jackie is not called Psyche. This is possible since in \underline{d} the speaker \underline{a}_d can be asserted to have the information that Jackie is called Psyche.¹² The abstract situation \underline{d} consists of set theoretic objects which are interpreted as specifying who the speaker is and various other things, among which is the assertion that the speaker has the information that Jackie is called Psyche -- even if this is not true (which it is not, by hypothesis). Now what is true is determined, as far as the semantics is concerned, by the model $\mathcal{M} = \langle \underline{M}, \underline{M}_0 \rangle$, and we shall suppose that according to \mathcal{M} Jackie is called Jackie and not Psyche. Then an utterance of

(8) Psyche is biting Molly.

at $\underline{d}, \underline{c}$ will describe situations in which Jackie is biting Molly, and we shall further suppose that among these is at least one actual situation, so the utterance is true.

Can we tolerate such a state of affairs? Situation semantics is rescued by the fact that it takes efficiency seriously. In comparing our intuitive judgement with the pronouncement by the semantic theory that the utterance of (8) is true, we must take into consideration not only the sentence uttered, but also the discourse situation \underline{d} . Since \underline{d} is non-factual, the sentence cannot be uttered at that discourse situation, and hence cannot actually be used to make this statement. The last sentence of the passage from Barwise and Perry (1983) cited above and repeated here highlights an important point.

If they were actual, what Joe said would be true, but to say it he would have had to say 'Molly is biting Jackie'.

Barwise and Perry distinguish between what Joe said and saying it (or saying what is said). The interpretation represents only what is said. At the level of interpretation any inverse information has been lost, whereas the statement, represented as a triple $\langle \underline{d}, \underline{c}, \varphi \rangle$, retains all the information.

Barwise and Perry regard as a virtue of their theory the fact that it contains structured interpretations, which allows them to

pull language off the world.

We must have a way of representing the way the world is, one that is independent of the language whose meanings we are trying to study. In this regard, standard model theory is woefully inadequate, for the structures it uses to represent the world all presuppose some specific language. (S&A, p. 29)

But structured interpretations and this distance between language and the world have another result, namely, that interpretations gain independence from language. For example, there are interpretations of 'Jackie is biting Molly' in which Jackie is called 'Molly', even interpretations in which Jackie is a cat. This particularly happens where the utterance involves information that does not end up in the interpretation -- particularly the cases of names and referential uses of definite descriptions which we have been considering. To write interpretations in the form $d, c \llbracket \varphi \rrbracket$ is misleading, for the sentence uttered occurs in this notation; but the interpretation itself is simply a class of abstract situations, from which all reference to the sentence has disappeared. Therefore in situation semantics meaning must assume a more important role in relating structured interpretations to discourse situations. Linguistic meaning has been made a crucial and integral element of semantics.

Let us recount the progress we have made. We began with a passage which suggested that in Barwise and Perry's theory the truth conditions of some utterances appeared to be determined partly by factors, which interfered with the usual truth definition in terms of the interpretation of an utterance and a model. In investigating this issue, we saw that these factors were accommodated within the semantics by means of restrictions on the meanings of expressions, notably names and descriptions. These factors, which in situation semantics are finally not part of the interpretations of utterances, nonetheless operate within the semantics at a different level, mediating as part of meaning of certain expressions between those very expressions and their interpretations on occasions. The interpretation considered alone is "distant" from language and needs meaning to link it with sentences and discourse situations. The

result is a strain on the mesh between truth conditions as judged intuitively and as determined by interpretations and the model. Where are the truth conditions of statements determined? Does meaning pull truth conditions off the interpretation, involving other factors?

There are some clear statements that truth conditions are distinct from any pragmatic factors. Discussing Jonny's beliefs about Cicero, they say, 'This [that the relevant anchoring facts are those that anchor a concept of Jonny's that comprehends 'Tully'] is an implicature, or suggestion, not something that is part of the truth conditions of my report' (S&A, p. 264). At this point, the pragmatic factor, which plays a considerable role in the discussion by Barwise and Perry, does not help to determine the truth conditions of the report. Semantics and pragmatics are held separate.

A problem facing the innocent semantic theorist is to account for the gap between our intuitive judgements of truth conditions and the truth conditions as they are actually determined by the semantics (interpretation and situation structure). Barwise and Perry's response is to trace the grounds for our intuitions on some matters to pragmatics, specifically Gricean principles that govern what we say in which kinds of circumstances. For example, we are constrained in which expressions we use on occasions by Maxim A, which is:

Speaker: When using an attitude report to explain a person's actions (as opposed to using it as evidence of what the world is like) do not use terms describing or suggesting the agent's unapplied concepts or irrelevant anchors or other modes of recognition not used by the listener. Listener: Assume that the speaker is referring to the agent's applied concepts, relevant anchors and other modes of recognition used by the agent. (S&A, p. 258)

This is so, even though the semantics accords truth to utterances which we would intuitively consider false and which employ expressions we are pragmatically constrained from using. Again, semantics and pragmatics are held separate, but the price is a tension between the semantics and our intuitions.

On the other hand, there are passages in the book where the truth conditions appear not to be determined exclusively in terms of the interpretation and the situation structure. In addition to the passage in which we began our inquiry, consider the scenario where one day Melanie sees Jim at a distance eating an anchovy, and the following day is introduced to him without recognising that he is the same person that she saw the previous day. Does she believe, of Jim, that he was eating an anchovy or not, for she has, in situation semantics terminology, two unmerged concepts of Jim? Barwise and Perry say of this case:

[...] we think that in certain circumstances, it would be appropriate and true for Jim to say, "She didn't believe that I had eaten an anchovy", and in other circumstances, appropriate and true for him to say, "She believed that I did eat an anchovy". (S&A, p. 255; emphasis added)

Semantics and pragmatics merge in this kind of case.

Finally, let us return to the case where someone speaks falsely. Suppose that Peter approaches Melanie and utters 'Hi! I'm Jim', when his name is not 'Jim'. His utterance is true if the interpretation contains an actual situation, and false otherwise. That is, the utterance is false if the interpretation does not contain an actual situation, or if for some reason we are unable to construct an interpretation -- if some subsentential expression does not contribute what is expected of it. 'I' will designate the individual p (Peter), but which individual does 'Jim' designate? There are two conditions for a name β to designate an individual a on an occasion d, c :

$$(1) \quad c(\beta) = a_c$$

$$(2) \quad a_d \text{ has the information that } a_c \text{ is a } \beta.$$

Now the individual to whom Peter is referring by means of 'Jim' is $c(\text{Jim})$, but we are not told how to establish who this is. Is he referring to himself, or to someone else, and if the latter, who?¹³

Thinking of the two conditions as constraints on which individuals may be contributed by the name, anyone who is such that



he is a Jim and Peter is referring to him is contributed to the overall interpretation. In any case, if an individual x , $x \neq p$, were contributed, the situation built up using x would not be factual and therefore could not help to make the utterance true. But, indeed, no one may thus be contributed, and the interpretation of the name, strictly speaking, would be the empty set. Since this is likely, the name fails to donate any individual to the interpretation of the whole utterance.

The truth definition is such that an utterance is false in the event, either of the interpretation not containing an actual situation, or of the utterance having no interpretation. Something more than the interpretation and the situation structure has a role in determining the truth conditions of utterances. More specifically, when the utterance is false, this can be the result of something breaking down among the relata of the meaning of the expression uttered -- the sentence, the utterance situation $\langle d, c \rangle$, and the interpretation. Thus, on the occasion when the utterance is true, part of the work done in making this so is carried out at this point. That the speaker of 'I'm Jim' be called 'Jim' is part of the truth conditions of the utterance simply in virtue of the fact that if he is not, then the semantics determines the utterance as false.

We have now clearly crossed over the boundary into pragmatics: these sorts of issues are part of pragmatics, not semantics. Even according to the wide view of semantics, if there is a "performance failure" with an utterance, it is a pragmatic failure and not something within the province of semantics.

2.3 Conclusion

The conclusion to be drawn from this discussion is that meaning has a central role in situation semantics. The consequence of admitting structured interpretations for utterances is that meaning must be involved in relating these interpretations to the sentences and situations in which they are asserted. Linguistic meaning

concerns the relation between expressions and their references -- how this expression comes to have that as its reference -- and all this is an integral part of semantics. Barwise and Perry therefore accept that characterisation of the province of semantics which I have called wide semantics. However, pragmatics is not swallowed up by wide semantics, for it has its own distinctive domain of questions.

Chapter Three: Meaning, Interpretation, and the Setting

3.0 Introduction

In the last chapter we looked at some of the issues involved in the question of where to draw the line between semantics and pragmatics in an attempt to see what was happening in this area with situation semantics and whether there were any (radical) changes to the traditional theory. In the present chapter, in a further attempt to find out what the situation is with the new theory, I shall examine meaning, interpretation and setting closely, and try to see just how these concepts are to be understood in situation semantics.

More precisely, I shall look first at the important concept of the interpretation of an expression on an occasion of utterance. To make this analysis as precise as possible, I shall base it on the formulation of the theory as found in Aliass, although we shall consider only Determiner-free Aliass, which will allow us to keep the analysis simpler and perhaps see more clearly the essential structure of situation semantics. I shall ask what the interpretations of expressions, basic and compound, are. Barwise and Perry claim that meaning exists in the world, relating different parts of the world; yet their semantics introduces numerous abstract entities, which assume the major theoretical roles. It is necessary to ask, therefore, of the various kinds of expressions, whether their references are in the world, whether it is important that they are, and whether they might equally well be considered as abstract theoretical entities.

The analysis of meaning as it is conceived in situation semantics will bring us to focus on the notion of a setting, around which this chapter revolves. We shall be concerned to discover what settings are and what their theoretical role is. Barwise and Perry formalise their version of settings in the appendices on Aliass, but some passages in the main text of their book motivate a significantly different, yet formally equivalent, conception of settings, one which

I shall explore and formalise in this chapter. To conclude with, we shall consider the implications of this notion of the setting for the concept of meaning.

3.1 Meaning and interpretation in situation semantics

In Determiner-free Aliass there are three lexical categories: relation symbols (RS's), individual terms (IT's), and tense markers (TM's). We are told that 'The lexicon comes with an interpretation function \mathcal{I} that associates objects with some of these items.' (S&A, p. 301) In fact, if R is a relation symbol, $\mathcal{I}(R)$ is a relation (a property if R is unary); relations and properties are primitives of the theory and urelements for the set theory. If J is a name, $\mathcal{I}(J)$ is an individual.¹ Individuals, too, are also both primitives and urelements. Tense markers, the only other lexical category, however, are not in the domain of the interpretation function.

There are various expression-forming rules which build other grammatical categories out of these basic, lexical categories. In Determiner-free Aliass, there are three intermediate or, as Barwise and Perry call them, syntactic categories (categories between lexical categories and the category of sentence). From an IT we can construct a noun phrase (NP); from a RS and a TM we can construct a located relation phrase (LRP); and from an LRP and an optional NP we can construct a property phrase (PrPh). Finally, the category of sentence (S) is constructed out of an NP and a PrPh.

Expressions of each of these categories have a meaning, which is consistently a four place relation $\mathcal{d}, \mathcal{c} \Vdash [\alpha] \Vdash \sigma, e$, where α is an expression of arbitrary category. Thus, although the setting σ will provide or contribute different entities depending on the category of the expression α , we have a uniform concept of meaning in Determiner-free Aliass. The issues at the level of reference, or interpretation, are not so simple, however, and constitute our main concern at present.

What are the interpretations on an occasion, of expressions of

each grammatical category in turn? Throughout the development of situation semantics, the main guiding idea of the semantics as innocent has been interpreted as meaning that a singular term should be seen as referring to an individual, and a predicate as referring to a relation, so that a sentence consisting of a predicate and terms refers to just those situations in which the relation holds among the designated individuals -- this whether the sentence is embedded in another or not. (This simple picture is soon complicated slightly by the entry of locations.) Individuals and relations are taken to be parts of the real world, as are situations; in the construction of the formal theory, however, whereas singular terms and predicates do refer to these real world individuals and relations, sentences refer to abstract situations -- a significant move, which means that henceforth we shall have to be careful in distinguishing real situations from abstract situations.

A sentence uttered on an occasion (a discourse situation \underline{d} and speaker connections \underline{c}) refers to an abstract situation. Strictly, the meaning of a sentence φ is the relation $\underline{d}, \underline{c} \Vdash \varphi \Vdash \sigma, \underline{e}$, but as the setting is empty this can be written $\underline{d}, \underline{c} \Vdash \varphi \Vdash \underline{e}$.² The interpretation is the class of situations which can appear as the rightmost relatum when the relation is written down. Although singular terms and predicates refer to individuals and relations respectively, and this is certainly how we think of their references, it does seem strange that the meaning of these expressions is the relation $\underline{d}, \underline{c} \Vdash [\text{Jackie}] \Vdash \sigma, \underline{e}$ and not $\underline{d}, \underline{c} \Vdash [\text{Jackie}] \Vdash j$, for example. The sentential case suggests that we could reinterpret situation semantics and take the interpretation of an arbitrary subsentential expression χ as the class of the entities that appear on the right hand side of the meaning relation as this is written down (ie. the interpretation would be a class of pairs $\langle \sigma, \underline{e} \rangle$).

This idea seems to be related to what Barwise and Perry have in mind when they define what they call the value-free interpretation -- what we get out of meaning when we fix the discourse situation and speaker connections. (S&A, p. 150) Since their distinction between value-free and value-laden interpretations applies principally to

descriptions (it is when they define the semantics of descriptions that they make the distinction, although they intend it to apply to all kinds of expression), and since we do not have to deal with descriptions in Determiner-free Aliass, the two notions of interpretation collapse into one. Still, Barwise and Perry avoid altogether considering the class of pairs $\langle \sigma, e \rangle$ as the references (on occasions) of expressions. However, I wish to pursue this idea.

3.1.1 The interpretations of basic expressions

Both NP's and IT's refer to the same kinds of entities, for the meaning of a given expression of type IT remains the same when that expression is promoted to type NP. In fact there is very little difference between the two categories. There are two rules for forming NP's: (a) every IT is an NP, with the same SCat and meaning; and (b) a more complex rule, which allows an IT to be indexed so that it can function as the antecedent of some variable (ie. pronoun). Semantically, this makes no difference to the meaning or the reference of an NP, whichever way it is constructed from an IT.³

The referents of NPs and ITs are essentially individuals. However, the interpretation of an NP α according to this novel notion of interpretation I have suggested would be a class of pairs $\langle \sigma, e \rangle$, where σ is a setting (on Barwise and Perry's conception of a setting, a function from the distinguished indeterminate a to an actual individual; the rival conception of the setting which I will advocate will be explained below), and e is a situation -- any situation, as it turns out. Is it important whether we say that the meaning of 'Jackie' is the relation $\underline{d}, \underline{c} \llbracket \text{Jackie} \rrbracket j$ and the interpretation is j (not distinguishing between j and $\{j\}$), or that the meaning is $\underline{d}, \underline{c} \llbracket \text{Jackie} \rrbracket \sigma, e$ and the interpretation is the class of all pairs $\langle \sigma, e \rangle$ such that the relation holds? Or should we follow Barwise and Perry, who seem to regard the meaning of the term as the relation $\underline{d}, \underline{c} \llbracket \text{Jackie} \rrbracket \sigma, e$, yet want to say that an utterance of it designates Jackie, and that the interpretation is Jackie

herself?

There seems to be little motivation for thinking of the interpretation of 'Jackie' as the class of pairs $\langle \sigma, e \rangle$ such that $d, c \models [[\text{Jackie}]] \sigma, e$ when we consider a sentence in which 'Jackie' occurs, and ponder on the role of that term in the sentence, and what it might contribute to the interpretation of the sentence (ie. its own interpretation). The interpretation of 'Jackie is barking' is the class of abstract situations in which Jackie is barking at some contemporary location: it is that simple; there are no abstractions involved. All the components of this situation, excepting the truth value are parts of the real world on the situation semantics ontology.⁴ Amending a well known remark of Donald Davidson's, it is plainly incredible that 'Jackie' means anything different, or refers to anything other than Jackie.

The interpretation of a relation symbol R is a relation (also called 'property'), exactly the relation which \mathcal{I} maps R to. The kinds of relations that are involved here are what we might call 'unlocated' relations, borrowing some terminology from Barwise and Perry; that is, they are relations $r(x_1, \dots, x_n)$, none of whose relata are space-time locations with the import that another relation $r'(x_1, \dots, x_{j-1}, x_{j+1}, \dots, x_n)$ (for $1 \leq j \leq n$) holds at that location (the location having occurred as the j th relatum). Given that we are accustomed to think of both located and unlocated relations in situation semantics, the relations that predicates refer to are of the unlocated kind.⁵ The novel conception of the interpretation, never seems to have the same appeal with relation symbols as with the other kinds of basic expression -- the interpretation is just the relation itself, or perhaps the relation in a "situation frame" $\langle l, r, a, b, i \rangle$ (for $r \in \mathcal{R}^2$), where the indeterminates are to be regarded as place holders.⁶

Tense markers refer to locations; this is intuitively what a TM contributes to the described situation being built up as the interpretation of the sentence. But in what sense can we say that, in the semantics of Aliass as given, a TM refers to or designates a location? We have the following clause in connection with TM's:

L3. TM: There are tense markers $\underline{n}_1, \underline{n}_2, \dots$ (present tense) and $\underline{w}_1, \underline{w}_2, \dots$ (past tense), with $\text{SCat} = \{1\}$. Their meanings are given by:

$\underline{d}, \underline{c} \llbracket \underline{n}_j \rrbracket \sigma, \underline{e}$ iff $\underline{l}_\sigma = \underline{c}(\underline{n}_j)$ and $\underline{l}_\sigma \circ \underline{l}_d$.

$\underline{d}, \underline{c} \llbracket \underline{w}_j \rrbracket \sigma, \underline{e}$ iff $\underline{l}_\sigma = \underline{c}(\underline{w}_j)$ and $\underline{l}_\sigma < \underline{l}_d$. (S&A, p. 302)

The location we are interested in -- and the location which the TM, if any expression, contributes to the described situation -- is \underline{l}_σ , but it does not appear on the right hand side of the meaning relation as written out. We have a situation very similar to that with terms: the right hand side is a pair $\langle \sigma, \underline{e} \rangle$, of which the situation \underline{e} is arbitrary, and what we are really interested in is the entity to which σ maps a particular indeterminate in $\text{SCat}(\underline{t})$ (where \underline{t} is the TM) -- namely, the indeterminate \underline{l} .

The puzzling thing is that Barwise and Perry view the meaning of α as the relation $\underline{d}, \underline{c} \llbracket \alpha \rrbracket \sigma, \underline{e}$, and yet consider the interpretation of α as either an individual, a relation, or a location. Perhaps the relation between meaning and interpretation is not quite the straightforward one presented in the main text of Situations and Attitudes: the interpretation is not what is left, or what we obtain from the meaning, when we fix the discourse situation and speaker connections. Perhaps we ought not to regard meaning in the way Barwise and Perry do in the book, and instead think of the meaning of a TM \underline{t} , for example, as the relation $\underline{d}, \underline{c} \llbracket \underline{t} \rrbracket \underline{l}$, where $\underline{l} = \underline{c}(\underline{t})$ and \underline{l} is appropriately related to \underline{l}_d (what the appropriate relation is would be determined by what kind of marker \underline{t} is). The alternative is to think of meaning as Barwise and Perry do -- the relation $\underline{d}, \underline{c} \llbracket \alpha \rrbracket \sigma, \underline{e}$ -- but to allow interpretations to be classes of pairs $\langle \sigma, \underline{e} \rangle$.

The two approaches -- Barwise and Perry's and the alternative one I am currently considering -- are perhaps more similar than they appear: given $\langle \sigma, \underline{e} \rangle$ such that $\underline{d}, \underline{c} \llbracket \alpha \rrbracket \sigma, \underline{e}$, we can find the reference of α , \underline{x} (I shall use ' \underline{x} ' as a variable ranging over interpretations of expressions from any grammatical category), and thus assert that $\underline{d}, \underline{c} \llbracket \alpha \rrbracket \underline{x}$ holds. (This assumes, of course, that we are always able to decide which indeterminate $\underline{x} \in \text{SCat}(\alpha)$ is the

relevant one, ie. the one which σ maps to the interpretation of \mathcal{A} ; but this is easy to find once we read off the grammatical category of \mathcal{A} .⁷⁾ As I shall show below, we can represent the relations between \underline{x} , σ , and \underline{e} in a calculus. (From these relations, we can calculate the right class of pairs of σ and \underline{e} , given \underline{x} ; or we can find the reference, given a pair $\langle \sigma, \underline{e} \rangle$; and given an event and the reference, we can calculate a class of settings.) Although there is a great difference between the interpretation of an NP as an individual and as a class of pairs $\langle \sigma, \underline{e} \rangle$, the two notions of interpretation are formally equivalent.

We have now considered sentences and all the basic lexical categories of Aliass: IT's, RS's and TM's, and also the category of NP (which I have assimilated to the basic lexical categories, because it is not significantly different from IT's). Their designations are (abstract) situations for sentences, and for the other cases, respectively individuals, relations and locations (and individuals for NPs). I have also begun to sketch the alternative conception of the semantics, on which the interpretations of non-sentential expressions are classes of pairs. We now turn to the remaining syntactic categories.

3.1.2 The interpretations of compound categories

Given an RS and a TM, we can construct an LRP; what do such expressions designate? The grammar of Aliass is so constructed that for a sentence $\underline{x}_1 \underline{R}_t \underline{x}_2$, \underline{R} a RS, \underline{t} a TM, and the \underline{x}_j NP's ($j = 1, 2$), we first "pull out" the NP's to get an LRP, next we "pull out" the TM (and the negation symbol - in those cases where it occurs) to leave the RS. The LRP is a category that appears at an intermediate stage (the extremes being the whole sentence and the basic lexical categories). Our intuitions suggest that we can understand the LRP as standing for a relation's holding (or not holding) among a certain number of objects (the objects being as yet unspecified) at a definite and given location. That is, it stands for a relation at a

fixed location -- a located relation (hence the name located relation phrase). But what kind of entity is a located relation? In the context of our aims in the present work, we are interested in whether it is something out there in the world, as individuals and unlocated relations and properties are (on the situation semantics ontology), or just something we have constructed in the set theory. We clearly have abstract, constructed entities which we could regard as the interpretations of LRP's, analogously with the case of basic expressions -- classes of pairs $\langle \sigma, e \rangle$ such that $\underline{d}, \underline{c} \models [R_t](\sigma, e)$ -- as candidates for the interpretation on the occasion $\underline{d}, \underline{c}$; but is there an alternative?

The problem with conceiving of located relations as things in the world is that they do not seem to be parts of the world in the same way as individuals and relations, because they are both located (that is, tied down to a particular region of space-time) and unspecific (that is, there is no mention of precisely which objects are involved and how). They fall halfway between situations -- located, but also specific as to which objects are involved and in which relations they stand in that situation -- and relations, which are neither located nor specific, possessing a full generality.

It is a simple matter to construct a set theoretic entity, or kind of entity, particular instances of which can function as the references of LRP's. We could simply take as the interpretation the class of pairs $\langle \sigma, e \rangle$. Alternatively, we could try and put together just those entities we want -- the relation $\underline{r} = \mathcal{J}(\underline{R})$, the location \underline{l}_σ , and the truth value \underline{tv}_σ . We would get a set theoretic entity that we might represent as:

$$\langle \underline{l}_\sigma, \underline{r}, _, \underline{tv}_\sigma \rangle, \text{ or: } \langle \underline{l}_\sigma, \underline{r}, _, _, \underline{tv}_\sigma \rangle$$

where the '_' is a place holder. Because Aliass has only one- and two-place relations we need only consider these cases. In the more general case it would be better to deal with the increased variability by treating all the relata as constituting a single sequence, so that in the representation they always take up one place. Thus the entity we might use to represent the interpretation

would be: $\langle \underline{l}, \underline{r}, \underline{t}, \underline{tv} \rangle$. Again, these several possibilities are formally equivalent.

The other category in Aliass is that of the PrPh. I need say no more about it than that the remarks above in respect of LRPs also apply *mutatis mutandis* to it. The PrPh is similar to the LRP; in fact, some PrPh's just are LRP's. The structure of the other PrPh's is that of an LRP with an NP filling the 'object' position, the 'subject' position remaining empty. As far as our present interests are concerned, no new points arise with PrPhs.

3.1.3 The structure of abstract situations

Barwise and Perry speak of both real and abstract situations, but since sentences designate abstract situations, and no expression designates real situations, I shall be concerned for the most part only with the abstract variety.

Abstract situations are set theoretic entities; they are identified as sets constructed in the generation of the universe of sets from the urelements of the theory. A situation is a set of zero or more situational sequences (as I shall call them to distinguish them from constituent sequences) of the form $\langle \underline{l}, \underline{y}, \underline{i} \rangle$ where \underline{l} is a location, \underline{y} is a constituent sequence $\langle \underline{r}^n, \underline{a}_1, \dots, \underline{a}_n \rangle$, with \underline{r}^n an n -place relation and the \underline{a}_j individuals, and \underline{i} is either 0 or 1 (intuitively a truth value). Thus, a situation is a set of sequences whose members are urelements or sequences of urelements; the only exception is the number, 0 or 1, which is neither an urelement nor a sequence of urelements. Nonetheless, its presence is unobjectionable: we would expect the natural numbers⁸ to be available in any case -- suppose them to have been identified with certain sets generated in the usual manner.

Notice that all the entities that are put together set theoretically to construct the sequences that are members of the abstract situation are, excepting the truth value, designated by expressions that are elementary, that is, ones which are not

resolvable into other basic expressions. (Mostly, this is to say that they are lexical categories; but there is also the case of the negation operator or negation symbol $-$, which is not a member of any lexical category; it is connected with -- we cannot say it designates -- the truth value.) If every situation in the interpretation of an utterance of a sentence $\varphi = \alpha_1 R_t \alpha_2 \dots \alpha_n$ contains the situational sequence $\langle \underline{l}, \langle \underline{r}^n, \underline{a}_1, \dots, \underline{a}_n \rangle, 1 \rangle$, then the TM designates \underline{l} , the relation symbol designates \underline{r}^n , the \underline{n} individual terms designate the $\underline{a}_1, \dots, \underline{a}_n$, and the 1 arises from the absence of a $-$ in φ .⁹

We have a slight complication here in the manner in which the truth value is determined. It is, as I have said, determined by the presence or absence of $-$. Let us put aside any worries that the absence of a symbol can determine something that is contributed to the construction of the situation described, or designated, by the whole sentence. Our concern is with designation rather than being contributed to the described situation. It is not correct to speak of $-$ designating the truth value 0 (or its absence designating the truth value 1): as an inspection of the LRP rule will show, the definition of the meaning of $-R_t$ is such that $-$ has a role rather like that of $\&$ in the definition of the meaning of $\underline{S}_1 \& \underline{S}_2$. The symbol $-$ does not have a meaning definable on its own (nor does $\&$), and like $\&$ it is not an entry in the lexicon: it has a syncategorematic status.

We can easily find abstract set theoretic entities to serve as references expressions of intermediate category; but if we want to regard their references as existing in the real world, there is a problem in making the resulting semantics conform to the principle of compositionality. Suppose, to take a concrete example, we are dealing with a RS \underline{R} and a TM \underline{t} at the stage when they are combined to yield the LRP \underline{R}_t . The RS designates a relation \underline{r} , the TM designates a location \underline{l} , and let us suppose that we have not yet chosen the designation of the LRP: all we have fixed is that it is something which the theory presupposes is a part of the real world, and which I shall denote by ' \underline{x} '. The principle of compositionality holds that the designation of a complex expression is a function of the

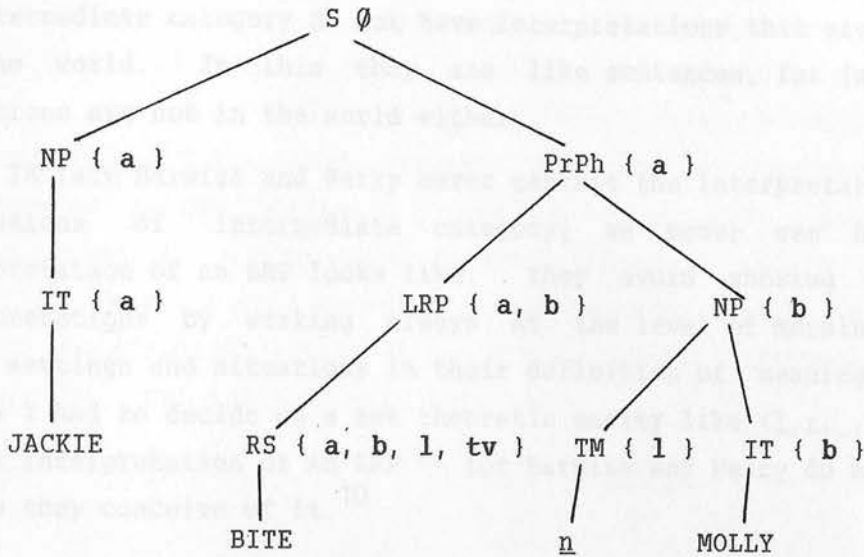
designations of its parts. However, we cannot show that \underline{x} is composed out of \underline{r} and \underline{l} , for these three are all real world entities, and all must be primitive objects from the point of view of the theory; we cannot relate them, although we could if some or all of them were set theoretic objects. (Our problem is not solved simply by writing \underline{x} as ' \underline{r}_1 ' or ' $\underline{r}(\underline{l})$ ' or something like that.) The entity \underline{x} simply does not have the appropriate structure: it is not related to \underline{l} and \underline{r} in a way which displays the fact that it is designated by an expression composed in a certain way out of the expressions which are designate \underline{l} and \underline{r} .

If we decide upon some abstract, set theoretic entity as the designation of \underline{R}_t , which would solve the technical problem associated with compositionality, we have embarked upon the construction of a surrogate reality, isomorphic to the world. In fact, this is just what has happened with real and abstract situations, for the level of situations faces the same problem: we can provide abstract situations to serve as the interpretations of whole utterances, but the theory will not work if "situations" (the interpretations of utterances) are real situations -- they do not have suitable, exhibitable structure.

In linguistics it has become standard practice to associate sentences with derivation trees, which display the structure of those sentences. Such derivation trees employ grammatical categories, equivalent to the intermediate or syntactic categories LRP and PrPh in Aliass. As for the reasons why theoretical linguists want to introduce non-sentential, non-terminal categories into their theory, suffice it to say that these categories are required for a recursive definition of possible (ie. grammatical) sentence structures in the language: with lexical insertion rules, the language (ie. the set of grammatical sentences) can be defined. In referential semantics, we have to provide a semantics for them, and that entails giving them a designation or reference.

The sentence JACKIE BITE_n MOLLY in Aliass is derived from the

following tree (where the SCats are shown in set brackets):



The interpretation function \mathcal{J} assigns j to JACKIE, m to MOLLY, and r_B to BITE as their designations, and the designation of the whole sentence is the class of situations which contain the sequence $\langle \underline{l}, \langle r_B, j, m \rangle, 1 \rangle$. Apart from the truth value 1, all the entities that are put together to construct the situation come from the basic expressions. The intermediate categories do not contribute anything to the reference of the whole sentence; they indicate the subsentential structure that we perceive. (The truth value enters as a primitive entity at the stage when BITE and \underline{n} are composed -- at the semantic level, when r_B and \underline{l} are composed; it is not designated by anything.)

The reference of the sentence has a "flat" structure, although the tree is hierarchical in structure. The embedding of the sequence $\langle r_B, j, m \rangle$ within the main sequence is incidental with respect to the present point, for situations could be represented according to alternative conventions. In any case it is not designated by, nor does it correspond to, any syntactic constituent of the sentence. So, although the relation r_B , the location \underline{l} , and the truth value 1 get packed together into some abstract object to provide a reference for the LRP, when we have reached the sentential level, all of the intermediate interpretations have been unpacked to deliver the

references of the basic expressions: j , m , r_p , l , and 1 , and the situation is made up of these. Unlike basic expressions, expressions of intermediate category do not have interpretations that are things in the world. In this they are like sentences, for (abstract) situations are not in the world either.

In fact Barwise and Perry never exhibit the interpretations of expressions of intermediate category; we never see what the interpretation of an LRP looks like. They avoid showing us such interpretations by working always at the level of meaning and by using settings and situations in their definition of meaning. That is why I had to decide on a set theoretic entity like $\langle l, r, _, i \rangle$ above as the interpretation of an LRP -- for Barwise and Perry do not show us how they conceive of it.¹⁰

3.1.4 A comparison of situation semantics with standard theory

The main idea in formal semantics, in regard to the compositional structure of sentences, has been to see a term as designating an individual, and a predicate as designating either a function or a set -- it makes little difference which, since we can move back and forth between the set and its characteristic function. The sentence formed from a term and a monadic predicate is true just in case the individual designated by the term is in the set (equivalently, just in case the function maps that individual to 1). Let us call this Principle T:

- (T) If t is a term and F a monadic predicate letter, then the designation of t is an individual, the designation of F is a function from individuals to a truth value, and the sentence Ft is true iff the designation of F applied to the designation of t yields the truth value 1.

Now Barwise and Perry, by building all the possibilities into the meaning of expressions, and factoring out unwanted possibilities by unification, have brought their theory visibly closer to the

standard approach than was the original idea of situation semantics. To illustrate this claim in detail, I shall consider the simple, but representative case of a sentence Ft , consisting of a monadic predicate F and a term t . To enlarge the scope of this comparative analysis and to take account of efficiency, I shall use a modification of T to include contexts of utterance. Context will be represented by the coordinate c : the d, c of situation semantics will be compressed, for the present purposes, into a single utterance situation or contextual coordinate that contains all the information in both the discourse situation d and the speaker connections (the original c). The modified principle is:

- (Tc) If t is a term and F a monadic predicate letter, then the designation of t at c is an individual, the designation of F at c is a function from individuals to a truth value, and the sentence Ft is true at c iff the designation of F at c applied to the designation of t at c yields the truth value 1.

Truth, it will be noted, must also be relativised to a context of utterance because of the efficiency in the language.

To be precise, the definitions that follow should be considered relative to a language L and a model \mathcal{Q} . For simplicity I shall take L to consist only of individual constants and n -place predicates (for $n = 1, 2, \dots$), but there is nothing in principle to prevent us from comparing the semantic analyses for syntactically more elaborate languages. Exactly what the model \mathcal{Q} is depends on the theory in question. A model according to the standard theory is a pair $\langle D, V \rangle$, where D is a set (the domain of individuals) and V is a function which assigns to each term t an individual a in D , and for each n , assigns to each n -place predicate F a function $V(F)$ from n -tuples of individuals to truth values. A model for my formulation of situation semantics is just Barwise and Perry's pair $\langle M, M_0 \rangle$, as defined in Barwise and Perry (1983). Again for simplicity, I shall suppress explicit reference to the model at various points, but this should cause no confusion. Finally, the comparison will actually be made only for monadic predicates.

The standard theory then gives us the following analysis A1.

The designation of \underline{t} with respect to \underline{c} (and \mathcal{Q} ; henceforth this reference will generally be omitted), written $\llbracket \underline{t} \rrbracket_{\underline{c}}$, is an individual (\underline{a} say); the designation of \underline{F} with respect to \underline{c} , $\llbracket \underline{F} \rrbracket_{\underline{c}}$, is a function \underline{f} from individuals to a truth value; and the designation of the sentence, $\llbracket \underline{Ft} \rrbracket_{\underline{c}}$, is a truth value. The sentence is true (in the model \mathcal{Q}) just in case it designates 1, ie. just in case $\underline{f}(\underline{a}) = 1$. We can summarise as follows:

$$(A1) \quad \llbracket \underline{t} \rrbracket_{\underline{c}} = \underline{a}$$

$$\llbracket \underline{F} \rrbracket_{\underline{c}} = \underline{f}: \underline{A} \rightarrow \{0, 1\}$$

$$\llbracket \underline{Ft} \rrbracket_{\underline{c}} = \underline{f}(\underline{a}) = 0 \text{ or } 1$$

$$\mathcal{Q} \models_{\underline{c}} \underline{Ft} \iff \llbracket \underline{F} \rrbracket_{\underline{c}}(\llbracket \underline{t} \rrbracket_{\underline{c}}) = \underline{f}(\underline{a}) = 1$$

(More strictly, we should write $\llbracket \underline{t} \rrbracket_{\underline{c}}^{\mathcal{Q}}$ for the designation of \underline{t} with respect to \underline{c} in the model \mathcal{Q} , and so on for the others.)

The analysis according to situation semantics gives us A2 below. Here too, again for reasons of simplicity, I have tried to suppress reference to the model $\mathcal{M} = \langle \underline{M}, \underline{M}_0 \rangle$; but the clause defining truth makes reference to the class \underline{M}_0 of actual situations and thus requires the situation structure to be brought into the picture explicitly. The designations of expressions in A2 are determined by the meanings of those expressions, which, following situation semantics, attach to expressions independently of the model.¹¹ The designation of a term \underline{t} with respect to \underline{c} is to be a set of pairs $\langle \sigma, \underline{e} \rangle$; the designation of a monadic predicate \underline{F} relative to \underline{c} is also a set of pairs $\langle \sigma, \underline{e} \rangle$; and the designation of the whole sentence \underline{Ft} with respect to \underline{c} is a set of situations, just as in situation semantics.¹² The sentence is true if one of these situations is actual:

$$(A2) \quad \llbracket \underline{t} \rrbracket_{\underline{c}} = \{ \langle \sigma, \underline{e} \rangle \mid \llbracket \underline{t} \rrbracket_{\underline{c}, \sigma, \underline{e}} \}$$

$$\llbracket \underline{F} \rrbracket_{\underline{c}} = \{ \langle \sigma, \underline{e} \rangle \mid \llbracket \underline{F} \rrbracket_{\underline{c}, \sigma, \underline{e}} \}$$

$$\llbracket \underline{Ft} \rrbracket_{\underline{c}} = \{ \underline{e} \mid (\exists \sigma) (\llbracket \underline{t} \rrbracket_{\underline{c}, \sigma, \underline{e}} \ \& \ \llbracket \underline{F} \rrbracket_{\underline{c}, \sigma, \underline{e}}) \}$$

$$\mathcal{M} \models_c \underline{Ft} \Leftrightarrow (\exists \underline{e})(\underline{e} \in \underline{M}_0 \ \& \ \underline{e} \in \llbracket \underline{Ft} \rrbracket_c)$$

I take it that any changes I have made are merely changes of notation or other superficial changes. A2 reflects the unificatory nature of composition in Aliass, a feature that is absent from A1, but we shall now show that this is not a fundamental difference.

The strategy for drawing out the parallels between A1 and A2 will be to define a third analysis A3, which will bear resemblances to both A1 and A2. It is hoped in this way to bridge the apparent differences between them. We shall derive A3 by making small modifications to A2; then, when we have A3, we shall compare it with A1.

In A3, we shall make (the form of) the designations of expressions more like the designations in A1, but shall retain the model theory of A2. Designations are therefore independent of the model. The designation of a term \underline{t} relative to \underline{c} will be an individual \underline{a} . That a term should designate an individual is not foreign to situation semantics, as is evident from the preceding discussion. The pairs $\langle \sigma, \underline{e} \rangle$ in $\llbracket \underline{t} \rrbracket_c$ in A2 all have the property that we are really after the individual \underline{a}_σ ; \underline{e} is arbitrary and superfluous. Thus, we have not changed the "real" designation of \underline{t} , only the means of specifying it. The designation of a monadic predicate \underline{F} relative to \underline{c} in A3 is a function from situations and individuals to a truth value, this function from $\mathcal{E} \times \underline{A}$ being fixed by the meaning of \underline{F} . (In fact, the designation of \underline{F} will map to 1 only those pairs $\langle \underline{e}, \underline{a} \rangle$ such that \underline{a} is \underline{F} in \underline{e} .) Again, this is just a basic reformulation of A2: there the pairs $\langle \sigma, \underline{e} \rangle$ in $\llbracket \underline{F} \rrbracket_c$ are such that σ maps \underline{a} to the individual which is \underline{F} in \underline{e} . We have preserved precisely the relevant information in A3: each situation \underline{e} and setting σ such that $\langle \sigma, \underline{e} \rangle$ is in $\llbracket \underline{F} \rrbracket_c$ in A2 corresponds to the pair of that same situation and some individual which the function $\llbracket \underline{F} \rrbracket_c$ (in A3) maps to 1. In fact, $\llbracket \underline{F} \rrbracket_c$ (in A3) maps all and only those pairs $\langle \underline{e}, \underline{a} \rangle$ to 1 for which there is a pair $\langle \sigma, \underline{e} \rangle$ in $\llbracket \underline{F} \rrbracket_c$ (in A2) with $\underline{a} = \underline{a}_\sigma$.

The designation $\llbracket \underline{Ft} \rrbracket_c$ of the sentence \underline{Ft} at a context \underline{c} in A3 is a set of situations, precisely those \underline{e} such that $\llbracket \underline{F} \rrbracket_c(\underline{e}, \llbracket \underline{t} \rrbracket_c) = 1$.

In A3 we have a model theory very similar to the usual situation semantics one; \underline{Ft} is true (in a model $\mathcal{M} = \langle \underline{M}, \underline{M}_0 \rangle$) if some situation in $[[\underline{Ft}]]_c$ is a member of the set of actual situations \underline{M}_0 . To summarise:

$$(A3) \quad [[\underline{t}]]_c = \underline{a}$$

$$[[\underline{F}]]_c = \underline{f}: \mathcal{E} \times \underline{A} \rightarrow \{0, 1\}$$

$$[[\underline{Ft}]]_c = \{ \underline{e} \mid [[\underline{F}]]_c(\underline{e}, [[\underline{t}]]_c) = 1 \} = \{ \underline{e} \mid \underline{f}(\underline{e}, \underline{a}) = 1 \}$$

$$\mathcal{M} \models_c \underline{Ft} \Leftrightarrow (\exists \underline{e})(\underline{e} \in \underline{M}_0 \ \& \ \underline{e} \in [[\underline{Ft}]]_c)$$

I have already pointed out that A3 faithfully preserves the essential structure of A2 as far as the designations of the term and the predicate are concerned. In A3 we have eliminated the need for the distinguished indeterminates and the setting; we have done so by making explicit, for each expression, the entity we really consider to be the reference of that expression. Also, the truth definition is the same: the designations of an entire sentence at a context in A2 and A3 are sets of situations; the major change in transforming A2 into A3 is the different formulation of the reference of the predicate. Thus, I conclude that there is no substantial difference between A2 and A3.

Nor is there as much difference between A1 and A3 as perhaps there seems to be at first. The designations of the term in both theories are the same -- an individual in each case. The real difference lies in the fact that A3 quantifies over situations, whereas A1 does not. In fact, A3 is just A1 plus abstract situations; if we were to remove the situations from A3, we would be left with A1. In such a modification of A3, we leave the semantics of the term alone. The new definition of the reference of the predicate is simply a function from individuals to a truth value -- exactly as in A1. And without situations, the semantics for the sentence would assign to \underline{Ft} as reference the value of $[[\underline{F}]]_c([[\underline{t}]])$ -- again, exactly as in A1. The truth definition in A3 is so structured as to take account of the fact that sentences refer to (sets of)

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$$(A3) \quad [[\underline{t}]]_C = \underline{a}$$

$$[[\underline{F}]]_C = \underline{f}: \mathcal{E} \times \underline{A} \rightarrow \{0, 1\}$$

$$[[\underline{Ft}]]_C = \{ \underline{e} \mid ([[\underline{F}]]_C(\underline{e}, [[\underline{t}]]_C) = 1) \} = \{ \underline{e} \mid \underline{f}(\underline{e}, \underline{a}) = 1 \}$$

$$\mathcal{M} \models_C \underline{Ft} \Leftrightarrow (\exists \underline{e})(\underline{e} \in \underline{M}_0 \ \& \ \underline{e} \in [[\underline{Ft}]]_C)$$

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situations, but otherwise captures the same idea as that of A1, which is just a theory instantiating Tc.

The model theoretic apparatus invoked by each of A1 and A3 is significantly different: they represent the world differently, and this has consequences for the definition of truth. A model for A1 is a pair $\langle \underline{D}, \underline{V} \rangle$ of a domain of individuals \underline{D} and an interpretation function \underline{V} which assigns to each term \underline{t} in the language an individual and to each \underline{n} -place predicate \underline{F} in the language a function from \underline{n} -tuples of individuals to truth values. According to A1 the world contains individual objects but not properties; which qualities (or properties) hold of which objects can be specified only through language, which is what \underline{V} does. A model for A3, on the other hand, is a pair $\langle \underline{M}, \underline{M}_0 \rangle$ of sets of factual and actual situations. Although these are abstract situations, they represent the world as composed of real situations, which consist of objects having properties and standing in relations to one another. In A1, therefore, it is the model which determines which individual a term designates and what the extension of a predicate is, whereas in A3 designations are fixed by meaning independently of the model, whose function is merely to define what is the case, and hence, derivatively, which sentences are true. To do this requires apparatus that can represent possible states of the world, and expressions are assigned references from this stock of entities. The A1 theory defines which sentences are true and only thereby what is the case in the world.

What this analysis shows is that the main and fundamental differences between situation semantics and traditional semantic theory exist not at the formal level (though they are superficially different), but are due to the philosophical premises that underlie each kind of theory.¹³ I return to this question of the relation between situation semantics and traditional theories in chapter six, tackling it in more detail by analysing the ontology of situation semantics in the manner of Kaplan (1975). My aim here has been to show that, when any confusion occasioned by the notation as been removed, in its essential formal structure the basic situation semantics framework is not so distant from standard theories.

3.2 The notion of the setting

3.2.1 Two conceptions of the setting

Settings are bound up with the semantics of subsentential expressions -- that is why they are introduced into the semantics, and the settings associated with sentences are null. I shall discuss how we should conceive of the setting, some ways of representing it, and seek to discover the nature of settings and of their role in the theory.

In their book, Barwise and Perry find it attractive to include settings in their representation of the notion of linguistic meaning and to view the linguistic meaning of an expression α as a relation $\underline{d}, \underline{c} \llbracket \alpha \rrbracket \sigma, e$, with the setting as one of the relata. At first it appears that the setting for an expression α consists of other situational elements which, together with the reference or interpretation of α in that utterance, combine to produce the described course of events (hence the name 'setting'). If α is a sentence, the setting σ is void, but for subsentential expressions σ would contribute, in effect, whatever is "missing" from the interpretation of α in order for it to constitute a course of events. Alternatively, one may think of the setting as whatever needs to be added to the interpretation of α to produce a situation. Of course, how much is missing (how much needs to be added) will vary a great deal, depending on the grammatical category of α . Thus, if α is the tensed VP 'is biting Molly', all that is needed to construct a course of events from its interpretation is an individual, which is just what σ provides:

$$\underline{d}, \underline{c} \llbracket \text{IS BITING MOLLY} \rrbracket \sigma, e$$

iff

in e : at $\underline{l} = \underline{c}(\text{IS})$: biting, \underline{a}_σ , Molly; yes

where \underline{a}_σ is the individual provided by σ .¹⁴

Now this is an interesting development of the basic theory. In

what follows we shall be interested to arrive at some evaluation of exactly what settings are; in particular, we want to know whether they are parts of the world or theoretical constructs. The significance of this question has to do with how, in situation semantics, we see language contacting the world: only for sentences is meaning a relation between utterance situation (represented by the pair $\langle \underline{d}, \underline{c} \rangle$) and the described situation \underline{e} , while with other expressions the setting enters into meaning. An utterance of such an expression describes a part of the world (a situation) only with the help of -- only in the context of -- a setting, in effect, only when additional factors have been determined. In situation semantics, as in the standard Fregean theory, a critical importance is given to the sentence as the central linguistic unit for contacting extra-linguistic reality.¹⁵

Although Barwise and Perry think of the meaning of an arbitrary expression α generally as a relation $\underline{d}, \underline{c} \llbracket \alpha \rrbracket \sigma, \underline{e}$,¹⁶ they make somewhat surprising decisions as to precisely what the setting is (and as to what it contributes towards the described situation) for different types of expression. When they first introduce the concept, it seems that the setting associated with an expression α uttered in the context of an assertive utterance \underline{u} provides other situational elements which can be put together with the designation of α to constitute a course of events:

If we think of the utterance of an expression α as taking place in the context of an assertive utterance \underline{u} , then \underline{u} provides not just a discourse situation and connections, but other situational elements σ that the utterance of α helps combine into the described situation \underline{e} . In the case of a tensed VP, this setting σ is just an individual, but for other types of expressions, the settings will be more elaborate. Thus, we can think of the meaning of α as a relation $\underline{d}, \underline{c} \llbracket \alpha \rrbracket \sigma, \underline{e}$ between discourse situations, connections, a setting σ provided by other parts of the utterance, and a described situation. This is the format in which we present our discussion of the meaning of subsentential expressions. (S&A, p. 128)

On this understanding of settings, which I shall call the 'original' conception of a setting, from the meaning of an expression α as a

relation $\underline{d}, \underline{c} \ll [\alpha] \gg \underline{\sigma}, \underline{e}$ we obtain the equation

$$\underline{d}, \underline{c} \ll [\alpha] \gg \text{"plus"} \underline{\sigma} = \underline{e}.^{17}$$

Now this is what happens for tensed VPs, as illustrated above, and indeed for VPs in general: what is missing from $\underline{d}, \underline{c} \ll \text{IS BITING MOLLY} \gg$ to make an entire course of events is an individual, which is supplied by the setting.

The semantics of terms, however, is defined so that the setting contributes to the described situation in the opposite way. Instead of $\underline{\sigma}$ providing what is missing from $\underline{d}, \underline{c} \ll [\alpha] \gg$ to constitute a course of events, $\underline{\sigma}$ is just $\underline{d}, \underline{c} \ll [\alpha] \gg$ itself. The meaning of 'I' is defined thus:

$$\underline{d}, \underline{c} \ll \text{I} \gg \underline{a}_{\underline{\sigma}}, \underline{e} \text{ if and only if } \underline{a}_{\underline{\sigma}} = \underline{a}_{\underline{d}}. \text{ (S\&A, p. 131)}$$

The setting, then, can operate in either of these two ways. While it is true in Aliass that for all expressions, $\underline{\sigma}$ is an anchor for precisely those indeterminates in the SCat of the expression, this does not rationalise the diverse functions of the setting for different kinds of expression. It simply means that which indeterminates there are in an expression's SCat becomes correlated with the strangely diverse functions of the setting -- one could say that the disorder spreads. There is a slight change, too, between the way meaning is written down in the text and the way it is written down in the appendices. In the main text Barwise and Perry write $\underline{d}, \underline{c} \ll \text{I} \gg \underline{a}_{\underline{\sigma}}, \underline{e}$ and not $\underline{d}, \underline{c} \ll \text{I} \gg \underline{\sigma}, \underline{e}$ -- probably because $\underline{\sigma}$ only anchors \underline{a} and they do not there explain exactly how $\underline{\sigma}$ provides the individual. I shall call this the 'alternative' conception of a setting. This conception does not constrain the situation \underline{e} which appears in the meaning of a term at all, whereas on the original conception of the setting, the relation $\underline{d}, \underline{c} \ll \text{I} \gg \underline{\sigma}, \underline{e}$ mutually constrains $\underline{\sigma}$ and \underline{e} (for given $\underline{d}, \underline{c}$) for all expressions: if we fix \underline{d} and \underline{c} , then the relation holds only for those pairs $\underline{\sigma}, \underline{e}$ such that

$$\underline{d}, \underline{c} \ll \text{I} \gg \text{"plus"} \underline{\sigma} = \underline{e} \text{ or equivalently}$$

\underline{a}_d "plus" $\sigma = \underline{e}$.

On the original conception, σ is just \underline{e} with \underline{a}_σ "missing", as it were.

It is the alternative conception of the setting that is chosen for formal development in Aliass. On this conception the basic structure of the operation of composing meanings, whereby the meaning of a compound expression is determined by combining the meanings of the parts, is one of unification. We can combine an NP α and a PrPh β into a sentence $\alpha\beta$ (rule S1, S&A, p. 303). The meanings of the parts may be written as $\underline{d}, \underline{c} \llbracket \alpha \rrbracket \sigma_1, \underline{e}_1$ and $\underline{d}, \underline{c} \llbracket \beta \rrbracket \sigma_2, \underline{e}_2$. However, \underline{e}_1 is arbitrary and carries no information (it does not constrain anything), whereas σ_1 simply anchors the indeterminate \underline{a} to the referent of α . Further, σ_2 and \underline{e}_2 are highly constrained: \underline{e}_2 is a situation which gets everything β says about the world right (but since β omits which individual is concerned, \underline{e}_2 is free to have any individual involved), and in each particular instance σ_2 must anchor \underline{a} , the only indeterminate in $\text{SCat}(\beta)$ to the individual which, in the corresponding \underline{e}_2 , satisfies β . The result of the unification is that all the combinations of $\sigma_2, \underline{e}_2$ for which $\sigma_2(\underline{a}) \neq \sigma_1(\underline{a})$ are factored out, leaving us with those pairs σ, \underline{e} on which they agree.

Barwise and Perry take this course for the development of their theory because this is the way they solve a certain problem that has to be faced. The problem in question is this: in situation semantics each basic expression has a meaning, and when used in an utterance, this meaning determines an interpretation for that occasion. Interpretations have to be put together to build up the situations that will constitute the interpretation of the whole sentence, and the problem is to put them together in the right way. We might call this the problem of compositionality. It is when Barwise and Perry face up to this problem and realise the difficulty it presents, I think, that they decide to pursue the alternative conception of a setting. Their choice as to what kind of entity settings are to be is dictated to some extent by their adoption of a unification approach with composition: this is why they need to have settings performing two different functions (for different kinds of

expressions).

3.2.2 Developing the original conception of settings

The following presents a development of the original conception of a setting. Although, compared to the one Barwise and Perry adopt, this theory is more suitable for representing meaning as the relation $\underline{d}, \underline{c} \llbracket \alpha \rrbracket \underline{x}$ where \underline{x} is the interpretation of α with respect to $\underline{d}, \underline{c}$, I shall formulate the theory using σ and \underline{e} as they do; in this theory the two representations are interchangeable, so that formally it is immaterial which representation of meaning is chosen. For each type of expression, we regard the meaning of an expression α as a relation $\underline{d}, \underline{c} \llbracket \alpha \rrbracket \sigma, \underline{e}$ between $\underline{d}, \underline{c}$, a setting σ , and a described situation \underline{e} , such that the interpretation of α and the setting σ can be put together to construct \underline{e} . Given \underline{d} and \underline{c} , this relation mutually constrains σ and \underline{e} . Indeed, we can regard the class of all pairs $\langle \sigma, \underline{e} \rangle$ such that the relation holds for σ and \underline{e} as the interpretation of α , and write:

$$\underline{d}, \underline{c} \llbracket \alpha \rrbracket = \{ \langle \sigma, \underline{e} \rangle \mid \underline{d}, \underline{c} \llbracket \alpha \rrbracket \sigma, \underline{e} \}.$$

We shall tentatively represent the linguistic meaning of an expression α as a set of quadruples, $\langle \underline{d}, \underline{c}, \sigma, \underline{e} \rangle$.¹⁸

The idea behind this conception of the setting and which must be formalised is the idea expressed roughly above as \underline{a}_d "plus" $\sigma = \underline{e}$. To give a detailed formal treatment, we shall need some notation. Following through the idea that the setting is very like the described situation, only with an individual missing (in the case of tensed VPs), I shall first introduce a notation for writing down the relations between settings, individuals and situations, and afterwards develop the mathematical foundations. Thus, I shall write

$$\sigma = \underline{e}/\underline{a}$$

to signify that the setting is conceived here as the situation \underline{e} without the individual \underline{a} -- \underline{e} with \underline{a} missing. New entities will be

introduced into the semantics to represent settings, and it is over these entities, which might be called 'frames', 'structures', or indeed just 'settings', that we shall define an algebra which is to explicate the notion of "plus" above. We shall also write:

$$\underline{a} = \underline{e}/\sigma$$

$$\underline{e} = \underline{a} * \sigma = \sigma * \underline{a}.$$

The '*' denotes the algebraic operation "plus", yet to be defined, which combines two or more entities or structures.¹⁹

The representation of meaning as $\underline{d}, \underline{c} ([\alpha]) \sigma, \underline{e}$ in Barwise and Perry's theory is bound up with their choice of unification as the method for the composition of meanings. On their approach, the alternative conception, the relations $\sigma = \underline{e}/\underline{x}$, etc. do not always hold (eg. with an NP), so they cannot move back and forth between writing meaning as $\underline{d}, \underline{c} ([\alpha]) \underline{x}$ and as $\underline{d}, \underline{c} ([\alpha]) \sigma, \underline{e}$, nor can they extract one from the other. Since it is important to know what σ and \underline{e} are to effect the composition of the meaning of α with that of another expression when calculating the meaning of the compound expression, they must represent the meaning of α in the latter form (ie. $\underline{d}, \underline{c} ([\alpha]) \sigma, \underline{e}$). In contrast, with the present development of the original conception settings, we are free to represent meaning in the form $\underline{d}, \underline{c} ([\alpha]) \underline{x}$.

Mathematically, these new entities may be thought of as infinite matrices, and we would conceive of a course of events as a matrix also. Thus, a situation \underline{e} , defined as, say:

$\underline{e} := \text{at } \underline{l}_1: \underline{r}_1, \underline{a}, \underline{b}; \text{ yes}$

$\underline{r}_2, \underline{a}; \text{ no}$

$\text{at } \underline{l}_2: \underline{r}_3, \underline{b}; \text{ yes}$

would become the matrix:

$$\begin{pmatrix} \underline{l}_1 & 1 & \underline{r}_1 & \underline{a} & \underline{b} & 0 & 0 & \dots \\ \underline{l}_1 & -1 & \underline{r}_2 & \underline{a} & 0 & 0 & 0 & \dots \\ \underline{l}_2 & 1 & \underline{r}_3 & \underline{b} & 0 & 0 & 0 & \dots \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \dots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \end{pmatrix} \quad 20$$

We require matrices having an infinite number of rows because there is no limit to the number of relations that a situation can specify as holding at locations.²¹ Note that the truth value occurs now in column two: this change is necessary, because otherwise its column would fluctuate according to the number of objects the relation takes. In this regard, we do not want to compose all the individuals together into a sequence (of variable length) taking up just one column -- which might at first seem like an alternative solution -- because that would complicate the definition of the matrix operation *. We need an infinite number of columns in the general case because otherwise an arbitrary limit would be clamped down upon the number of relata relations can have. However, because of the connection between relations and predicates in the language, if we fix the relation symbols available in the language, if we fix the vocabulary of the language, so that there is some \underline{m} such that each relation symbol is an \underline{n} -place relation symbol for some $\underline{n} \leq \underline{m}$, then we would need at most $\underline{m}+3$ columns in these matrices. We shall employ infinite matrices and use zeroes as place holders filling the remainder of the matrix.

I shall simplify the discussion, but without loss of generality, by considering an expression $\alpha\beta$ with just two constituents, α and β . I shall use ' $[[\alpha]]$ ' to denote the meaning of α , the class of all quadruples $\langle \underline{d}, \underline{c}, \underline{\sigma}, \underline{e} \rangle$ such that $\underline{d}, \underline{c} \in [[\alpha]]$, $\underline{\sigma}, \underline{e}$. Now, just as we shall define an operation * over settings (and more generally over other structures too), I propose to define an operation '.' over meanings, which is to signify the composition of

the meanings of the parts to give the meaning of the whole. Then we may write: $[[\alpha\beta]] = [[\alpha]] \cdot [[\beta]]$ (I use infix notation for the binary case, but in general, for n operands, we would use prefix notation). This operation is defined in terms of $*$ thus:

$$[[\alpha]] \cdot [[\beta]] = \{ \langle d, c, \sigma, e \rangle \mid (\exists \sigma_1) (\langle d, c, \sigma_1, e \rangle \in [[\alpha]]) \\ \& (\exists \sigma_2) (\langle d, c, \sigma_2, e \rangle \in [[\beta]]) \\ \& e/\sigma = e/\sigma_1 * e/\sigma_2 \}.$$

With this conception of meaning, we can see perspicuously how the meanings of the parts combine to give the meaning of the whole expression, and also how the interpretations of the parts, represented as classes of pairs $\langle \sigma, e \rangle$ (or more appropriately, as classes of entities e/σ), are related to the interpretation of the whole.

The reader who would like to see the rigorous definition of $*$ should consult the appendix; in the remainder of this chapter I propose to investigate the implications of this representation of meaning.

3.3 The nature of settings and abstract situations

3.3.1 The continuity of settings with situations

We know that a setting must be conceived of relative to part of an utterance (ie. an utterance of part of an indicative sentence). On the original conception of a setting, the setting is (or provides) what is required, in addition to the designation of that part of the sentence, to construct the interpretation of the whole. If the part in question is 'Jackie' and the whole utterance is an utterance of the sentence 'Jackie is barking', then the setting ought to contribute the property of barking and the location. Are we to think of σ as just one thing -- some 'complex' of these two, or rather three, elements: a property, a location, and a truth value? Or is σ

just the collection of all of these 'other situational elements', each considered a separate entity? In the work above, I have taken σ to be a specific thing with a certain complex structure, composed of all the other situational elements. For Barwise and Perry too, σ is just one thing -- an anchor, which, when given the appropriate indeterminates (eg. a , l , tv), produces the situational elements (respectively, a_σ , l_σ , tv_σ).

Whichever representation one chooses, then, the setting welds these other situational elements together. The original conception of the setting, however, is very illuminating as to what the nature of this structure is. The question of what settings are is bound up with the question of what abstract situations are, for settings are essentially situations with holes, and the relation of the situational elements within settings is that relation which holds among the elements within a situation. The original conception of the setting makes this particularly clear, especially when the expression considered is a term, for then the setting has to contribute all the other various elements, all but an individual, to the situation. Our investigation into the nature of settings sheds light also on the nature of situations, for the close relation between setting and situation binds the nature of the internal structure of situations with the nature of the internal structure of sentences.

By considering the individuals, properties and locations as basic and primitive, and the interpretations of sentences as abstract situations built out of these primitives in a set theoretic manner (which is what Barwise and Perry actually do formally, disregarding their metatheoretical comments), we have gained the power to "pull out" pieces from situations. A setting will be an abstract entity, such as I defined above in terms of a matrix or perhaps, as Barwise and Perry prefer to see it, an anchor. Settings are "striving to be situations", they are "situations with holes". On this approach situations can be regarded as settings of a special kind, ones without holes.²²

The resulting continuity of setting and situation is one

advantage of developing the original conception. The alternative conception suffers from the confusion that arises from having settings operating one way in the case of some expressions (viz. VPs) and in another way in the case of others (viz. NPs). Their choice as to what a setting should be, and how it should function, accords with their unification approach to composition; but it also means they must represent settings as anchors. In turn this raises deep problems about their semantics, because meaning, which is the basic concept of situation semantics and assumes the fundamental role in the theory, includes a setting among its relata, which has a controlling function in the composition of interpretations. The formal representation of meaning has turned out to be rather different from the original understanding of the notion deriving from the ecological metatheory.

The meaning of a subsentential expression should show us how the expression can be used in various contexts to describe various situations. Consider the sentence JACKIE BITE_n MOLLY of Aliass. Starting with the interpretation of the relation symbol BITE (a relation), we transform this into a matrix with a lot of holes. As we add to the RS respectively the TM n and the truth value 1, the object NP MOLLY, and finally the subject NP JACKIE, these holes get filled, and the matrix eventually comes to represent the situation of Jackie biting Molly at a suitable location. There is no asymmetry between the constituents here, as there is in Barwise and Perry's theory: their unificatory approach requires them to choose some constituent (the relation symbol) whose interpretation is essentially the situation matrix with "holes" everywhere except the place corresponding to that constituent. It is not clear that this is so, since Barwise and Perry do not show us in the book what the interpretations of compound subsentential expressions of Aliass look like, but from the definition of the meaning of a binary relation symbol, namely

$$\underline{d}, \underline{c} \models [R^2] \mid \sigma, \underline{e} \text{ iff } \langle \underline{r}, \underline{a}_\sigma, \underline{b}_\sigma, \underline{tv}_\sigma \rangle \in \underline{e}(\underline{l}_\sigma)$$

where $\underline{r} = \bigcup (R^2)$, the interpretation is essentially the structure $\langle 1;$

$\underline{r}, \underline{a}, \underline{b}, \underline{tv}$.²³ (Cf. section 3.1.2 above.) In the theory currently under consideration, we can start with any constituent, transform from its interpretation to a matrix and add in the other interpretations. This point will be illustrated in detail.

The interpretation of the NP MOLLY is first combined with the interpretation of the LRP BITE_n to yield the interpretation of the PrPh BITE_n MOLLY. The interpretation of the LRP is represented as the matrix

$$\begin{pmatrix} \underline{1} & 1 & \underline{r}_B & 0 & 0 & 0 & \dots \\ 0 & 0 & 0 & 0 & 0 & 0 & \dots \\ \cdot & \cdot & & & & & \\ \cdot & \cdot & & & & & \\ \cdot & \cdot & & & & & \end{pmatrix}$$

and the interpretation of the NP is represented as

$$\begin{pmatrix} 0 & 0 & 0 & 0 & \underline{m} & 0 & \dots \\ 0 & 0 & 0 & 0 & 0 & 0 & \dots \\ \cdot & \cdot & & & & & \\ \cdot & \cdot & & & & & \\ \cdot & \cdot & & & & & \end{pmatrix}$$

These are combined, by the operation * to get the matrix

$$\begin{pmatrix} \underline{1} & 1 & \underline{r}_B & 0 & \underline{m} & 0 & \dots \\ 0 & 0 & 0 & 0 & 0 & 0 & \dots \\ \cdot & \cdot & & & & & \\ \cdot & \cdot & & & & & \\ \cdot & \cdot & & & & & \end{pmatrix}$$

When the matrices are set out thus, they perspicuously capture our intuitions about how the described situation is built up. It is equally possible to think of the meaning of MOLLY as the relation $\underline{d}, \underline{c} \llbracket \text{MOLLY} \rrbracket \sigma, \underline{e}$. A particular instance of $\langle \sigma, \underline{e} \rangle$ would be σ as the matrix with $\underline{1}, 1, \underline{r}_B$ and \underline{j} in it, (the matrix thus signifying the structure that holds among these situational elements as they are welded together in the setting,) and \underline{e} as the situation of \underline{j} biting

\underline{m} , represented in the same manner.

Continuing this analysis, let us suppose that we have $\underline{d}, \underline{c} \llbracket \text{BITE}_n \rrbracket \sigma_1, \underline{e}_1$ and $\underline{d}, \underline{c} \llbracket \text{MOLLY} \rrbracket \sigma_2, \underline{e}_2$. Now $\underline{m} = \underline{e}_2 / \sigma_2$; more precisely, however, it is not \underline{m} the individual, but the matrix containing \underline{m} , written out above, that is an element of the algebra and thus equal to $\underline{e}_2 / \sigma_2$. I shall write the matrix, exhibited above, as ' \underline{m} '. Let the referent of the LRP be $\underline{x} = \underline{e}_1 / \sigma_1$. The referent of the PrPh is $\underline{x} * \underline{m} = \underline{e} / \sigma$ where \underline{e} and σ are such that $\underline{d}, \underline{c} \llbracket \text{BITE}_n \text{ MOLLY} \rrbracket \sigma, \underline{e}$. The meaning of the PrPh could also be written

$$\underline{d}, \underline{c} \llbracket \text{BITE}_n \text{ MOLLY} \rrbracket \underline{x} * \underline{m},$$

illustrating that the referents of the parts are combined to produce the referent of the whole. What could be more natural? The definition of the matrix operation $*$ underwrites this simple notation.

3.3.2 The object NP problem

A problem arises for the way Barwise and Perry use settings to deal with the composition of meanings, which does not seem to be the best way, or even a good way, of handling the problem. It complicates the original theory of meaning, and we wonder what objects like settings, as these are thought of in Aliass, have to do with meaning. Their theory requires the introduction of distinguished indeterminates a , b , l , and tv , whose status is questionable. Too many theoretical artifacts are taking the centre stage. Moreover, the theory does not do what is required of it: let us consider what we might call the 'Object NP problem', a specific case of the problem of compositionality.²⁴

Our favourite example of a sentence of Aliass, namely JACKIE BITE_n MOLLY, consists, at one level of analysis, of a subject NP, an LRP, and an object NP. The SCats of these expressions are as follows:

SCat(JACKIE) = { a }

SCat(MOLLY) = { a }

SCat(BITE_n) = { a, b }

The problem now shows up quite clearly: both JACKIE and MOLLY are NPs and so both have only the distinguished indeterminate **a** in their SCat (rules L2 and NP1 of Aliass), but we require the setting to map the indeterminate **b**, not **a**, to the referent of MOLLY. No mechanism is provided in Aliass as defined in Barwise and Perry (1983) to solve the problem. All individual terms have the set { **a** } as their SCat (lexical rule L2), and so MOLLY starts off with this SCat; there is no change when MOLLY is elevated to an NP. Nor is there anything in PrPh2, the rule which governs the composition of the LRP and the NP to yield the PrPh. And there could hardly be a solution at this point, without radically altering the way meanings and interpretations are composed, for if one of the constituent parts is $\underline{d}, \underline{c}$ [[MOLLY] σ, \underline{e} with SCat = { **a** }, how could we just change this **a** to **b**, when that would require σ (and thus the meaning of MOLLY) to be changed as well. The Object NP Problem remains a problem for Barwise and Perry's approach.

Compositionality and the object NP problem present difficulties on the approach that employs the original conception of a setting. With this approach the problem appears when we try to transform from the individual \underline{m} to the matrix [\underline{m}]: we could have \underline{m} occur in the fourth column of the first row, with zeroes elsewhere, or in the fifth column of the first row with zeroes elsewhere, or indeed in the sixth, seventh, eighth, etc. column of the first row, if we have relations that take a sufficient number of relata. Once we have [\underline{m}], there is no problem in combining this matrix with the others.

Essentially the problem concerns how the location of Molly in the situation being constructed is determined. The name 'Molly' can occur in either subject or object position within sentences,²⁵ and which position it occupies determines the location Molly ought to take within the situation. However, it is no part of the meaning of 'Molly' that the name occurs in subject position (or object

position), so meaning is not sufficient to determine interpretation. The solution to the problem requires allowing access to syntactic information about the sentence uttered, which is contained in the discourse situation \underline{d} , one of the relata of meaning. Barwise and Perry, too, would have to allow this to solve the problem within the Aliass version of the semantics.²⁶

This point raises the question of whether entities like meaning, with which the semantics is concerned, are actually in the world as they are claimed to be. To solve the Object NP Problem requires the semantics to have access to the syntactic structure of the sentence uttered -- the interpretations of the subsentential expressions do not contain enough information on their own as to how the interpretations of the parts should be put together to produce the interpretation of the entire utterance. That is, the pieces of the world such as Jackie and the relation of biting that are interpretations of subsentential expressions do not combine by themselves to constitute compound interpretations. Situation semantics fails the principle of strong compositionality. So where does the extra information come from? If the problem can only be solved by allowing semantics access to syntax, have we not thereby introduced a syntactic or linguistic element into the semantics?

3.3.3 Settings and situation types

It is interesting to see if our representation of both settings and situations as matrices, which has proved very useful, can be extended: how do situation types (event types) fit into this picture? The difficulty with representing situation types as matrices is that in addition to the constituents of situations they contain indeterminates. The straightforward identification of event types as matrices, with holes replacing indeterminates, is not possible. There is a significant difference between a situation of type \underline{E}_1 and one of type \underline{E}_2 , where these types are defined as:

$E_1 :=$ at \underline{l} : loves, a , b ; yes

$E_2 := \text{at } l: \text{ loves, } a, a; \text{ yes}$

A situation is of type E_1 just in case in it someone loves someone at the location l ; in general the two individuals will be distinct, though they need not be. In a situation of type E_2 , they must be identical. We cannot represent this difference if we simply replace indeterminates by holes.

However, our basic intuition of certain parallels between situation types and settings as conceived here remains. In accommodating situation types to their theory, Barwise and Perry expanded the classes of primitives to include basic indeterminates; we could let matrices contain basic indeterminates too, and thus capture the above distinction, but is this the sensible course?

To do this would mean that situation types would be effectively settings with no holes, like situations, which is contrary to our intuition -- situation types are more like settings than situations. Indeterminates are a technical method of correlating holes in certain cases, and we should therefore treat them as such. We may want to introduce indeterminates into the matrix representation, or we may choose some alternative method of correlating holes.

3.4 Conclusion

This chapter divides into three sections. In the first I asked what kinds of things the interpretations of basic and compound expressions in Determiner-free Alias were; it was found that only the interpretations of basic expressions are things in the world: the interpretations of all other categories must be abstract theoretical entities. I also argued that it is possible to reinterpret situation semantics such that even the interpretations of basic expressions are abstract entities -- classes of pairs $\langle \sigma, e \rangle$. Moreover, I compared situation semantics with the traditional model theoretic semantics, which assigns individuals to terms and extensions to predicates, and showed that formally situation semantics is just the traditional theory plus quantification over situations.

In the second section I argued that the conception of the setting as originally presented can be developed as a rival to Barwise and Perry's formalisation of the setting in Aliass as an anchor for distinguished indeterminates, and that this original conception is formally equivalent to Barwise and Perry's formalisation.

In the third and final section, I investigated the nature of settings and argued that the continuity between settings and situations, which is especially clear on the original conception of the setting, discloses the nature of abstract situations. The picture that emerges from a study of the problem of compositionality and the object NP problem is that this common nature is essentially linguistic.

Chapter Four: Russell, Richards, and Situation Semantics

4.0 Introduction

Frege and Russell represent the two great traditions in the philosophy of language over the last century. They divide crucially on the issue of semantic innocence: Frege distinguishing between sense and reference, Russell declining to follow this and instead urging his theory of denotation. In this chapter I want to compare situation semantics with Russellian theory. In addition to considering Russell's own views, we shall compare the theory with the semantics developed by Barry Richards, which follows Russell closely. In Richards' system we have a full formal semantics for a range of grammatical constructions, and we can therefore compare it with situation semantics in detail.

4.1 Russell's views on language and the world

Russell's views of interest to us, on the relation of language to the world and the nature of propositions, are presented in The Principles of Mathematics (1903); in 'On Denoting' (1905); in his lectures 'The Philosophy of Logical Atomism' (1918); and in 'On Propositions' (1919), which, although following closely upon the lectures, presents different ideas from them. Russell called his view at this time the Philosophy of Logical Atomism; logical atomism construes the world as constituted out of many separate things: by a process of analysis we would eventually arrive at logical atoms, some of which are particulars and some of which are predicates or relations. These atoms are constituents of the world; the world also contains facts, which are the things in the world that make propositions either true or false. Facts are part of the real and objective world, they are as real as particulars; to describe the world we need to mention which facts it contains as well as which

particulars there are in it. (Russell, 1956, p. 183)

Facts fall into two classes, particular facts and general facts. An example of a particular fact is that of Socrates being mortal;¹ an example of a general fact is that of all men being mortal. Russell argues that a complete description of the world requires recourse to at least one general fact in addition to all particular facts -- namely, that these are all the facts there are. More specifically, general facts such as all men's being mortal cannot be derived from particular facts alone, such as a's being mortal, b's being mortal, etc. One needs in addition the general fact that all men are among those here enumerated. (Russell, 1956, p. 235)

The simplest kinds of facts are those consisting of something being predicated of a single particular. Atomic facts consist of one or more particulars satisfying a predicate. Russell did not think that there were disjunctive facts that would make the proposition p or q true, but he did envisage negative facts.² As well as atomic facts, there are facts, such as Othello's believing Desdemona loves Cassio, involving an attitude, which do not consist of a single predicate and a suitable number of particulars. I shall say more about these kinds of facts in conjunction with the propositions that correspond to them, to which subject we now turn.

It is well known by those familiar with Russell's work that he changed his opinions frequently. I intend to review his thoughts about propositions briefly, and then to condense out a fixed position, which will be a useful reference point for the sequel.

In The Principles of Mathematics Russell distinguishes some constituents of propositions, but believes that the proposition is more than the totality of these constituents. The proposition 'A differs from B' has as constituents: A, difference, B. 'Yet these constituents, thus placed side by side, do not reconstitute the proposition.' (p. 49) The "extra" is some 'ultimate notion of assertion' which is lost when we break the proposition up into its parts. Russell here differs from Moore, who located propositions in the world, and identified true proposition and reality: 'The truth

that "I exist" differs in no respect from the corresponding reality "my existence". (Passmore, 1966, p. 203; see also Moore, 1899, 1903) While Russell would almost agree, he finds some 'ultimate notion of assertion' in the proposition 'Caesar died' which is absent from the corresponding part of reality, the event of Caesar's death.

A proposition ... is essentially a unity, and when analysis has destroyed the unity, no enumeration of constituents will restore the proposition. The verb, when used as a verb, embodies the unity of the proposition, and is thus distinguishable from the verb considered as a term, though I do not know how to give a clear account of the precise nature of the distinction. (Russell, 1903, p. 50)

We consider the verb as a term when we think of it as a thing, or when we focus our thoughts on the verb itself, which necessitates our removing it from its place in the proposition. At this stage, therefore, there was for Russell something puzzling about the nature of propositions, which concerned the way the constituents were held together within the proposition. This is quite an important idea, and one we shall return to.

When he came to write 'On Denoting', Russell thought of propositions as entities which could have individuals as constituent parts; we are not told in that article what the other parts of propositions are conceived to be, or how all the parts are related. Propositions are, of course, spoken about and referred to by expressions in natural language or logical notation: Russell uses ' $\underline{C}(\underline{a})$ ', where \underline{a} is a constant, to mean a proposition, and ' $\underline{C}(\underline{x})$ ', \underline{x} a variable, to designate a propositional function. This view of the nature of propositions -- as complex entities composed out of individuals contributed by singular terms and other constituents (attributes) contributed by verbs -- is what we shall take as representative of Russell's thought. For Russell, the propositional function is intensional: two propositional functions $\underline{C}(\underline{x})$ and $\underline{C}'(\underline{x})$ may be logically equivalent, yet the proposition $\underline{C}(\underline{a})$ is not the same proposition as $\underline{C}'(\underline{a})$.

In the 1918 lectures, propositions are what are made true or

false by facts, but they are no longer themselves parts of the objective world. Nor are propositions names for facts, as is easily demonstrated from the observation that there are always two propositions corresponding to any one fact; one of the propositions is made true and the other is made false by the fact. Russell at this stage conceived of propositions as linguistic entities:

A proposition, one may say, is a sentence in the indicative, a sentence asserting something, not questioning or commanding or wishing. [...] A proposition is just a symbol. It is a complex symbol in the sense that it has parts which are also symbols. (Russell, 1956, p. 185)

Symbols for Russell were things that "mean" something else. His provisional definition of propositions and facts is:

That the components of a proposition are the symbols we must understand in order to understand the proposition;
That the components of the fact which makes a proposition true or false, as the case may be, are the meanings of the symbols which we must understand in order to understand the proposition. (Russell, 1956, p. 196)

(Part of the reasoning for regarding this as a provisional definition is that certain components of molecular propositions: 'or', 'not', etc., do not correspond to anything in the facts corresponding to these propositions as wholes.)

The section in the lectures on beliefs emphasises the view of propositions as those things which we believe. Nonetheless, the fact that corresponds to the proposition expressed by the sentence

(1) Othello believes that Desdemona loves Cassio.

does not have the form of a relation (believing) between a particular (Othello) and a proposition (expressed by 'Desdemona loves Cassio'). For Russell, 'It is just one fact that you have a belief' (Russell, 1956, p. 218). Behind this view lies the problem of false belief: the problem, if true belief were a fact that consisted of a relation between the agent and something else, of saying what that something else is. The case of false belief prohibits our regarding belief as

a relation to facts, but can one regard belief as a relation even to propositions? Russell continues:

You cannot say that you believe facts, because your beliefs are sometimes wrong. [...] You have to say that you believe propositions. The awkwardness of that is that obviously propositions are nothing. Therefore that cannot be the true account of the matter. [...] It does not seem to me very plausible to say that in addition to facts there are also these curious shadowy things going about such as 'That to-day is Wednesday' when in fact it is Tuesday. I cannot believe they go about the real world. It is more than one can manage to believe, and I do think no person with a vivid sense of reality can imagine it. (Russell, 1956, pp. 222,223)

It is difficult to think of false propositions as part of the world, part of the furniture of the world, and as entities that enter into facts as constituents. Therefore Russell refused to believe that the belief contains the proposition; rather, he believed that the belief contains the only the constituents of the proposition as constituents.³

Finally, in 'On Propositions' (1919), Russell asks 'Can the word "proposition" stand for anything except a form of words?' In that paper he had come to a view of propositions as constituted out of words; but his interest in psychology resulted in an attempt to go further, and so he writes not only of word-propositions, but also of image-propositions, the latter being regarded as primary.

From this brief summary we get a picture of the evolution in Russell's ideas on the nature of propositions. In his earliest stage, he regarded them as structures, parts of which (expressed by terms) are actual individuals, other parts of which are predicates, or verbs and thus linguistic, and the whole being put together in some way, which was not entirely clear but appeared to have to do with the proposition being asserted. The later Russell took the view that propositions were linguistic, and finally expressions were replaced by images. Of relevance to us in the present work is the view of his early period, when propositions can have individuals as their constituents.

4.2 Situation semantics and the ideas of Russell

Barwise and Perry tell us that they regard situations as the basic constituents of the world, even to the extent of making individuals, relations and locations subordinate. They want to account for individuals, etc. as "uniformities" across situations.⁴ The main issue underlying chapter three was how (abstract) situations and their components are related; what is the nature of abstract situations and their constituents, and how are these constituents held together within real situations? This issue reappeared in the discussion of Russell's ideas above (section 4.1) -- in his terminology, the issue is how propositions and their constituents, and facts and their constituents, are related. Russell saw the atoms of logical analysis -- particulars, predicates and relations -- and facts as the constituents of the world: the atoms and the facts are equally basic, for although facts can be analysed so that we discern the atoms that constitute their parts, facts are more than the collection of their parts.

Just as for Russell, with logical atomism, facts were the starting point as the constituent parts of the objective world, so real situations have been the starting point for Barwise and Perry, working from ecological realism. Although there are differences, it is fair to regard real situations in situation semantics as corresponding to facts in Russell's work. (I want to emphasise the similarities between their views as well as point out the differences.) Consider the similarity between the following two passages, the first from Russell, the second from Barwise and Perry:

The things in the world have various properties, and stand in various relations to each other. That they have these properties and relations are facts, and the things and their qualities or relations are quite clearly in some sense or other components of the facts that have those qualities or relations. (Russell, 1956, p. 192)

Reality consists of situations -- individuals having properties and standing in relations at various spatio-temporal locations. We are always in situations; we see them, cause them to come about, and have attitudes toward

them. The Theory of Situations is an abstract theory for talking about situations. We begin by pulling out of real situations the basic building blocks of the theory; individuals, properties and relations, and locations. These are conceived of as invariants or, as we shall call them, uniformities across real situations; the same individuals and properties appear again and again in different locations. (S&A, pp. 7,8)

The basic entity in each theory, whether fact or situation, is viewed as part of the world.

The first major difference between situation semantics and Russell's theory is that (abstract) situations can, and often do, contain more than one constituent sequence, and are thereby able to specify more about the world than facts. Not only do we have situations such as e_1 and e_2 , but also situations like e_3 :

$e_1 :=$ at $\underline{1}_1$: barking, Jackie; yes

$e_2 :=$ at $\underline{1}_2$: biting, Jackie, Molly; no

$e_3 :=$ at $\underline{1}_3$: eating, Jackie; yes
 eating, Molly; no
 at $\underline{1}_4$: reading, Jon; yes

In this way situations can describe more of the world than facts. As in Russell's theory, there are negative facts in situation semantics (cf. e_2), but unlike Russell, for whom there were no disjunctive or conjunctive facts, Barwise and Perry allow situations which support the truth of sentences that are conjunctions of subsentences, such as

(2) Jackie is barking and Molly is eating.

A consequence of situations having such structure is that in situation semantics we can give the truth definition for an utterance of (2) either directly, as if it were an atomic sentence, or indirectly, treating the conjunction in the normal manner in truth conditional semantics. For an arbitrary conjunctive sentence $p \ \& \ q$ we have the following two definitions of truth conditions:

$\mathcal{M} \models_{d,c} p \ \& \ q$ iff $(\exists e)(e \in \underline{M}_0 \ \& \ e \in_{d,c} \llbracket p \ \& \ q \rrbracket)$

and

$$\mathcal{M} \models_{d,c} p \ \& \ q \text{ iff } \mathcal{M} \models_{d,c} p \text{ and } \mathcal{M} \models_{d,c} q$$

The comparison with the connective \vee is instructive. We can give the truth conditions for an utterance of a sentence $p \vee q$ in either form, since we know how to find the interpretation of the entire utterance, given the interpretations of the subsentences p and q .⁵ However, there are no "disjunctive situations", abstract situations which specify that either p or else q . All the situations which support the truth of an utterance of $p \vee q$ do so in virtue of supporting the truth of one of the disjuncts.⁶

Consider also the connective \rightarrow : $\mathcal{M} \models_{d,c} p \rightarrow q$ can be defined as one would expect. If we read \rightarrow as material implication, then $p \rightarrow q$ is true at $\langle d, c \rangle$ in \mathcal{M} iff:

$$\mathcal{M} \models_{d,c} p \text{ materially implies } \mathcal{M} \models_{d,c} q$$

If we read \rightarrow as Barwise and Perry's strong consequence, then $\mathcal{M} \models_{d,c} p \rightarrow q$ iff $d, c \models [p] \subseteq d, c \models [q]$. Could the meaning of $p \rightarrow q$ be defined directly, as with the connectives $\&$ and \vee ? Because of its connection with deduction, \rightarrow tends to cause us to shift our thought to the metalevel, and we prefer to define it in terms of a relation between $d, c \models [p]$ and $d, c \models [q]$, rather than to define $[p \rightarrow q]$ directly. What would it mean for a situation e to be such that $d, c \models [p \rightarrow q] e$? Thus, no one believes there are "implicational facts" in the world; in situation semantics we have instead structural constraints between situations.

In the more recent development of situation semantics, Barwise has interestingly adopted the word 'fact' into the vocabulary of situation semantics and uses it to mean an atomic fact in the Russellian sense (Barwise, 1984, lecture 1). It is important to realise that facts for Barwise are not set theoretic entities like abstract situations, but are parts of the world, just as Russell conceived of them.

A located fact f consists of a sequence x_1, \dots, x_n ($n > 0$) of objects standing, or not standing, in a spatio-temporal relation r at a space-time location l . An unlocated fact f consists of a sequence x_1, \dots, x_n ($n > 1$)

of objects standing, or not standing, in a certain non-spatio-temporal relation r. (Barwise, 1984, lecture 1, p. 2)

Barwise then goes on to say how he intends to classify facts and real situations with set theoretic objects. The set theoretic object that corresponds to a fact is called a 'circumstance'.⁷

In situation semantics sentences designate situations, or more precisely, utterances designate classes of abstract situations. The rejection of Frege's choice of a truth value as the designation for sentences (utterances) has resulted in a major structural change to the semantics, with sentential references becoming more sensitive to the subject matter of the sentence. This feature enables an innocent semantics to get off the ground and the reference of an utterance, its interpretation, to perform some of the roles given to Fregean senses. In particular we are interested in whether the interpretations of utterances can be regarded as propositions. In an earlier version of the theory, a realistic proposition was a class of abstract situations which satisfied the monotonicity constraint, and thus something that could be designated by an utterance of a sentence (Barwise and Perry, 1981b, p. 699). Propositions, in the sense in which they occur in that paper, have no role in the 1983 theory, because they are proper classes and hence they do not correspond to anything that could be part of the causal order.⁸

There is an interesting remark on the use of 'realistic' in the term 'realistic proposition':

The adjective 'realistic' is here used to emphasize that these are constructs of real objects, properties, and locations, not things in someone's head. (Barwise and Perry, 1981b, p. 669)

But the point is that they are still constructs; realistic propositions in this sense are not to be found in the world.

There is a difference in the way that the theories of Russell and Barwise and Perry deal with the semantics of the attitudes. For Russell, the fact corresponding to a belief sentence consists simply of the agent having the belief he does: belief is not a relation to a

proposition. Belief certainly is not a relation that the agent has to a fact, since people can believe falsely. Construing belief as a relation that the agent has to a proposition can only be a façon de parler, for propositions are not really anything (see the quotation above). Rather, there is one large fact that the agent has the belief he does; the constituents of this fact are the agent, the predicate of believing, and the particulars and predicate of the embedded sentence:

It is not accurate to say 'I believe the proposition p' and regard the occurrence as a twofold relation between me and p. [...] Therefore the belief does not really contain a proposition as a constituent but only contains the constituents of the proposition as constituents. (Russell, 1956, p. 224)

Russell had in a way already abandoned the principle of compositionality at the level of reference when he regarded a proposition as more than the sum of its parts. Once we had analysed it into its constituents, he thought, -- individuals and a verb or predicate -- we had lost something: it was no longer the proposition, but just the collection of the constituents. Here, too, in the semantics of the attitudes, he relinquishes the principle of compositionality. When the embedded sentence, which on its own expresses a proposition and designates a truth value, occurs in a belief sentence as here, it does not express a proposition and does not designate anything. Indeed, semantically the embedded sentence is not a constituent of the whole utterance.

In situation semantics an effort is made to preserve the principle of compositionality. The embedded sentence 'Desdemona loves Cassio' in (1) designates (with respect to a discourse situation and speaker connections) a class of abstract situations just as usual, and believing is understood intuitively to be a relation between the agent and these situations. However, working out the details of this idea has proved problematic for the approach, and much of Situations and Attitudes is devoted to discussing the problems and trying to resolve them. Consideration of all these issues is postponed until later chapters, when we shall have

completed the basic analysis of situation semantics, and can treat them more profoundly.

4.3 Richards' theory

Of great importance to our analysis is the formal theory that Barry Richards has proposed. In this section I shall explain that theory, making comparisons with Russell's ideas; in the next section the theory will be compared to situation semantics, which promises to be a fruitful exercise. The semantics is laid out mainly in Richards (1974), and an extension for adverbs is given in Richards (1976).

On Richards' proposal there is, in addition to the object language, a family of languages $L(P, Y, \mathcal{L})$, indexed by the sets P , Y , and \mathcal{L} . An utterance of a sentence of the object language expresses a certain proposition. Much of Richards (1974) is concerned with theories of definite descriptions and names, which are regarded as pragmatically ambiguous, so that the extraction of a particular proposition as the one expressed in an utterance of an object language sentence is seen as part of pragmatics. Consider the following passage, quoted in chapter two and repeated here:

The pragmatic features of a sentence are those whose semantic import is determined only relative to an utterance or context of use. Indexicals, such as that and here, are among the familiar examples. Unless relativized to an utterance, a sentence containing an indexical is neither true nor false, for the indexical by itself has no definite referent and thus the sentence expresses no determinate proposition. (Richards, 1976, p. 355)

Today, pragmatic features of natural language such as indexicality have been subjected to considerable study, whereas in Russell's day attention focused on the "narrow semantic" properties of languages, mainly because these were the issues that arose in the study of formal languages and were regarded as the main semantic issues at the time. Richards recognises that something has to be said about this question, and so devotes a lot of space to it; but he sees it as part

of the pragmatic component of his theory.

Semantics comes into play only after the pragmatic component has done its work and delivered up the proposition expressed. This is the essential structure of Richards' theory: the input to pragmatics is an utterance, which is represented by the sentence and 'a point of reference' -- in general, such information about the context of utterance as is required to determine the proposition. The task of pragmatics is to determine the proposition expressed, which then becomes the input to the semantic component. Semantics is concerned with specifying truth conditions and detailing inferences. Significantly, this view of the relation between pragmatics and semantics locates many of the questions about reference within pragmatics. (Compare this view with that of Stalnaker, 1972, discussed in chapter two.)

In this theory, propositions are conceived very much in the manner of Russell. The proposition expressed by an utterance of an object language sentence is specified in terms of individuals and predicates, for example, as 'u loves v'. Here the 'u' and 'v' stand for the actual individuals involved; much care is needed to understand exactly what is involved here. Richards says:

The parameters are not names of these objects, nor are they used to refer to them; rather they stand in their stead. [...] It will be appreciated, therefore, that we are actually thinking of propositions somewhat as Russell once conceived of them, ie. as determined in part by the objects referred to rather than the singular terms used to refer to them. (Richards, 1976, p. 360)

When we speak of the proposition 'u loves v', then, we are using the symbols 'u' and 'v' in place of the individual objects concerned, and the proposition is the admittedly rather strange, quasi-linguistic entity that consists of these two objects and the predicate 'loves'. The proposition is not just the collection of these three entities: they are put together by the linguistic operation of concatenation (this aspect to Richards' theory receives attention shortly). Hence the proposition is this quasi-linguistic entity 'u loves v': that is, we are here exhibiting the proposition itself, rather than naming it

metalinguistically.

Because of the pragmatic ambiguity inherent in the object language and the view that dealing with it is part of pragmatics, not semantics, Richards introduces the level of the logical languages $\underline{L}(\mathcal{P}, \mathcal{F}, \mathcal{C})$ over which to define the semantic component of his theory. A language \underline{L} is determined by its set \mathcal{P} of predicate letters, its set \mathcal{F} of function letters, and its set \mathcal{C} of individual constants. An utterance of a sentence \underline{A} of the object language is connected to a formula φ in a language $\underline{L}(\mathcal{P}, \mathcal{F}, \mathcal{C})$ through the proposition expressed: the formula φ is chosen precisely because, under an interpretation, as a sentence of \underline{L} it expresses the same proposition as the utterance of \underline{A} . The semantic component of Richards' theory is a model theoretic semantics for the family of languages $\underline{L}(\mathcal{P}, \mathcal{F}, \mathcal{C})$.

Now comes a shift in the way we think of the theory. Rather than regarding the sentences of \underline{L} as expressing propositions, we can regard them as representing propositions. On this view sentences of a language \underline{L} under an interpretation are a theoretical explication of (Russellian) propositions. Consider a sentence $\underline{P}(\underline{t}_1, \underline{t}_2)$ of \underline{L} where $\underline{P} \in \mathcal{P}$ and \underline{t}_1 and $\underline{t}_2 \in \mathcal{C}$. We may think of $\underline{P}(\underline{t}_1, \underline{t}_2)$ as representing, say, the proposition that Jackie is biting Molly under the chosen model \mathcal{M} . Like Richards (1974), I am here using metalanguage names, not exhibiting expressions of $\underline{L}(\mathcal{P}, \mathcal{F}, \mathcal{C})$. Thus \underline{t}_1 and \underline{t}_2 are names in the metalanguage for Jackie and Molly respectively, \underline{P} is a name in the metalanguage for the suitably chosen predicate in \mathcal{P} , and $\underline{P}(\underline{t}_1, \underline{t}_2)$ is a complex name in the metalanguage for the appropriate formula of \underline{L} . Because the set of individual constants \mathcal{C} can be anything,⁹ we can choose \underline{L} so that \mathcal{C} includes Jackie and Molly, and so that the formula $\underline{P}(\underline{t}_1, \underline{t}_2)$ is a quasi-linguistic entity with components Jackie, Molly, and the predicate $\underline{P} \in \mathcal{P}$, which is interpreted in \mathcal{M} as biting. The sentence $\underline{P}(\underline{t}_1, \underline{t}_2)$ is proposed as a suitable candidate for (a representation of) the Russellian proposition expressed by the original utterance.

This shift in our understanding of the theory highlights the strange status of the language \underline{L} . Expressions of \underline{L} are sometimes the

usual kinds of linguistic object, as with the predicates; but at other times our intuitions are strained, for we are asked to think of any kind of object, including in particular physical objects such as Jackie and Ortcutt, as expressions of these languages. There is a tension here between Jackie, say, as physical object and as expression in a language $\underline{L}(\mathcal{P}, \mathcal{F}, \mathcal{C})$ where \mathcal{C} contains Jackie (ie. the physical object). By placing an object in the set \mathcal{C} , that same object becomes an expression in various languages \underline{L} . The situation is further complicated by the fact that, to return to the example, Jackie as expression is assigned as reference Jackie, the physical object, by the interpretation function. I have explained the syntax of the languages \underline{L} and indicated that we are intended to think of the closed formulae of these languages as propositions; I turn now to say something about their semantics.

A model for $\underline{L}(\mathcal{P}, \mathcal{F}, \mathcal{C})$ is an ordered pair $\mathcal{M} = \langle \underline{X}, \underline{V} \rangle$, where the domain \underline{X} is the union of the sets \mathcal{C} of individual constants and \underline{Y} of all sentences of \underline{L} ; and \underline{V} is a function which assigns extensions to each predicate letter $\underline{P} \in \mathcal{P}$ and function letter $\underline{F} \in \mathcal{F}$. More precisely, for each k -place predicate letter $\underline{P} \in \mathcal{P}$, $\underline{V}(\underline{P})$ is a k -place relation on \underline{X} ; and for each k -place function letter $\underline{F} \in \mathcal{F}$, $\underline{V}(\underline{F})$ is a k -place operation on \underline{X} . The reader will notice that \underline{V} has not been defined on \mathcal{C} ; partly we want each $\underline{c} \in \mathcal{C}$ to be assigned itself, and partly Richards deals with the model theoretic meaning of individual constants by defining another function \underline{S}^* on the set of closed terms. A term of a language $\underline{L}(\mathcal{P}, \mathcal{F}, \mathcal{C})$ is closed iff it is either:

- (1) an individual constant,
- (2) a sentence of $\underline{L}(\mathcal{P}, \mathcal{F}, \mathcal{C})$, or
- (3) an expression of the form $\underline{F}(\underline{t}_1, \dots, \underline{t}_n)$, where \underline{F} is an n -ary function letter and each \underline{t}_i ($i = 1, \dots, n$) is a closed term. (Richards, 1974, p. 434)

The function \underline{S}^* is defined by:

- (1) If \underline{t} is an individual constant or a sentence of $\underline{L}(\mathcal{P}, \mathcal{F}, \mathcal{C})$, then $\underline{S}^*(\underline{t})$ is \underline{t} ; and
- (2) If \underline{t} is a closed term of the form $\underline{F}(\underline{t}_1, \dots, \underline{t}_n)$, then $\underline{S}^*(\underline{t})$ is the value of $\underline{V}(\underline{F})$ at $\langle \underline{t}_1, \dots, \underline{t}_n \rangle$. (p. 435)¹⁰

Richards has split the interpretation function into two, \underline{V} and \underline{S}^* ; the net result, however, is that individual constants are assigned themselves, as members of the domain, as references. To illustrate, and perhaps make the point more clearly, Jackie, qua expression of a language \underline{L} , is assigned Jackie, qua physical object, as reference. Yet it is Jackie we are thinking of in both cases.

The goal of Richards' theory is to provide an analysis and explication of Russellian propositions -- propositions which have "bare" individuals as constituents, as opposed to having either designating expressions, concepts, or Fregean senses as constituents. In identifying the formulae of a language \underline{L} with Russellian propositions, Richards is claiming that the proposition is essentially a linguistic entity; its parts are individuals and predicates, but the way they are put together -- the thing that puzzled Russell -- is an operation which at bottom is the concatenation of linguistic expressions. In the next chapter we shall consider the abstract situations of Barwise and Perry's theory, where, if we consider abstract situations as analogous to propositions, the relation of the parts within the whole is affirmed to be non-linguistic and is represented by a set theoretic operation, set membership.

Notice that we can express within Richards' semantics a distinction between determinate and non-determinate propositions, which reflects Russell's distinction between particular and general propositions. We can make this distinction because a single sentence can be used to express either of these kinds of proposition on different occasions. It will be no surprise that these sentences contain definite descriptions.

Following Richards (1976), suppose Harry utters (3) and that

some individual w is such that both Harry intends to refer to w and Harry believes that w is the senior caretaker.

(3) The senior caretaker writes guide books.

Then this example satisfies Richards' conditions for Harry to refer definitely to w , and to determine a particular proposition, namely, that w writes guide books. Again, suppose John utters (3) and that John believes that exactly one person is the senior caretaker and intends to refer to whoever is the unique senior caretaker, but for all x , it is not the case that x is such that John intends to refer to x . Then, assuming w is the (unique) senior caretaker, John refers attributively to w . The proposition that John expresses in uttering (3) is, however, not that w writes guide books, but that whoever is the unique senior caretaker writes guide books, ie.

$(\exists x)(x \text{ is a senior caretaker} \ \& \ (\forall y)(y \text{ is a senior caretaker} \equiv y = x) \ \& \ x \text{ writes guide books}).$

This distinction is precisely Russell's distinction between particular and general propositions. The determinate or particular proposition involves an individual,¹¹ and the non-determinate or general proposition has a quantifier binding a variable (remember Russell's examples of general propositions: that all men are mortal, that all men are amongst those here enumerated).

The problems with propositional attitude contexts are pragmatic problems of reference for Richards; a sentence $aZ\varphi(t)$ with a singular term t inside a modal operator Z does not always allow either exportation of the term or existential generalisation. The context can be either transparent or opaque; traditionally the sentence has been regarded as having two readings, a de re reading and a de dicto reading. The opaque or de dicto reading does not generally permit exportation. In Richards' theory the modal cases are treated analogously to the nonmodal cases; the theory is therefore fundamentally innocent. As in the nonmodal cases, the pragmatic part of the theory determines which proposition a speaker u expresses in uttering a sentence $aZ\varphi(t)$ on an occasion, and only

then does the semantics take over, operating on this proposition in the usual manner.

The details are as follows. A speaker who utters (4) below on an occasion might express one of four kinds of proposition: he might have Scott in mind and intend to refer to him (two propositions), or he might not (another two propositions).

(4) George IV believed that the author of Waverley also wrote travel guides.

If the speaker has Scott in mind and intends to refer to him (if the speaker refers definitely to Scott), then he might express the proposition that Scott is such that George IV believed he wrote travel guides, that is, he expresses the proposition that Scott has the property of being believed by George IV to write travel guides. The other proposition which he might express by uttering (4) with definite reference is that Scott is such that George IV believed he was the author of Waverley and he wrote travel guides. Formulated differently, Scott has the property of being believed by George IV to be the author of Waverley and to write travel guides.

If no one is such that the speaker intends to refer to them in uttering the definite description in (4), but the speaker nonetheless refers to Scott, in virtue of the fact that Scott is the unique author of Waverley and that the speaker believes that exactly one person is the author of Waverley and intends to refer to him, in this attributive case the proposition expressed is that there is exactly one author of Waverley and George IV believed that he also wrote travel guides. The other proposition in the present case of attributive reference is that there is exactly one author of Waverley and George IV believed that he was the author of Waverley and also wrote travel guides. We can represent these four propositions as follows:

(5) a. \underline{s} has the property $\lambda \underline{u} \text{ Bel}(\underline{g}, \underline{W}(\underline{u}, \underline{t}))$

b. \underline{s} has the property $\lambda \underline{u} \text{ Bel}(\underline{g}, \underline{A}(\underline{u}, \underline{w}) \ \& \ \underline{W}(\underline{u}, \underline{t}))$

(6) a. $(\exists \underline{x})(\underline{A}(\underline{x}, \underline{w}) \ \& \ (\forall \underline{y})(\underline{A}(\underline{y}, \underline{w}) \equiv \underline{y} = \underline{x}) \ \& \ \underline{x} \text{ has the$

property $\lambda u \text{ Bel}(g, W(u, t))$

- b. $(\exists x)(A(x, w) \ \& \ (\forall y)(A(y, w) \equiv y = x) \ \& \ x \text{ has the property } \lambda u \text{ Bel}(g, A(u, w) \ \& \ W(u, t)))$

The notational conventions I have adopted here are intuitive: 's' stands for Scott, 'g' for George IV, 't' for travel guides, 'w' for Waverley, 'W' for 'writes', and 'A' for 'author of'.

Like Russell's account, this theory is innocent: no intensional entities are invoked, and the semantics is the same in this respect in the modal and nonmodal cases. When the description is used referentially, the proposition expressed is not simply one of the form George IV believed that p, for some proposition p, an analysis that Russell also rejects when the proposition is understood as having the structure that 'believes' related George IV and p. Rather the form is that the individual s has a certain property, $\lambda u \text{ Bel}(g, W(u, t))$. While Russell clearly tells us what form the proposition expressed does not have -- namely, that George IV believed that p -- he does not say what form it does have. All we know is that the proposition has as constituents: George IV, believing, Scott, and (the property of) writing travel guides. In his analysis, Richards goes beyond Russell: he takes some of these constituents and constructs the property of being believed by George IV to write travel guides; then the proposition expressed by the utterance of the whole sentence is just that Scott has this property.

On the other hand, when the description is used attributively, the proposition expressed is that there is a unique author of Waverley and he is believed by George IV to write travel guides. In this case, the same complex property, $\lambda u \text{ Bel}(g, W(u, t))$, is satisfied by an individual, though the individual in question is whoever makes true the proposition represented above (6a) with an existential quantifier.

The structure of Richards' theory (pragmatics and semantics) can now be seen. An utterance determines a proposition, and I have looked at the four kinds of proposition that can be expressed, the differences resulting from a pragmatic ambiguity in definite descriptions. Thus the task of the pragmatic part of the theory is

to determine the proposition expressed when a sentence is uttered on an occasion. There are determinate or particular propositions, in which a particular individual has a specified property; and there are general propositions, where there is a unique something or other, and it has a specified property. The specified property in each case is generated from the other elements of the sentence, and the procedure is really no different, whether the sentence contains a modal operator or not. In all of this, Richards' approach is fundamentally Russellian and innocent. Most important of all for us is the fact that Richards uses linguistic concatenation of expressions to represent the relation that holds among the constituents of a proposition.

4.4 Situation semantics and Richards' theory

The issues to be borne in mind as we compare situation semantics and Richards' theory are the following. First there is the question of where the boundary between semantics and pragmatics is drawn by each theory, and what is dealt with at the different levels or components. I shall be concerned with the basic structure of the semantics in each case, concentrating on the mathematical structure and excluding philosophical or meta-theoretical commentary (there is little by Richards in any case, but the exposition of situation semantics is full of it). Further, we shall seek to determine which entity in situation semantics can appropriately be regarded as the proposition. Finally, I shall consider, briefly here but in detail in the next chapter, both the relation between the abstract entities of the semantics and the real world, an enterprise on which Barwise has been especially concerned to focus attention, and the nature of the relations that hold among the abstract entities.

Both the theories acknowledge the need for the study of language to be concerned with the situations in which language is uttered. Richards says, at the beginning of his (1974): 'Following a recent trend, we accept that any adequate theory of reference must be

pragmatically based.' (p. 361) As a consequence, sentences only express propositions when uttered at a point of reference, as Richards says, consisting of an ordered pair $\langle \underline{u}, \underline{t} \rangle$, where \underline{u} is the speaker and \underline{t} is the time of utterance. This matter is at the heart of situation semantics; the authors Barwise and Perry go to considerable pains to emphasise their conviction that the formal semantics of natural language has been too much influenced by the model theoretic semantics of mathematical and formal languages, resulting in the neglect of such properties as efficiency, exemplified by the phenomenon of indexicality. The two theories are based upon different positions regarding the issue of wide or narrow semantics, as I called it in chapter two. Whereas for Richards semantics is about giving a theory of reference, for Barwise and Perry it is about a theory of linguistic meaning, of those factors that govern how an expression, used on an arbitrary occasion, has the interpretation it does with respect to that occasion.

Richards conceives of propositions as linguistic entities. As I have shown, the proposition expressed is not so much expressed by, but represented by and regarded as a closed formula $\varphi \in \underline{L}$. This formula is also, from another point of view, a compound, quasi-linguistic entity composed out of real world individuals and predicate letters (and function letters!) of \underline{L} . It is at once linguistic in being a formula of a language, and yet non-linguistic in having among its constituents parts of the world; therefore are there these two perspectives towards it. The operation of concatenation in \underline{L} has taken on the burden of representing the relation, whatever it is, that holds between the constituents in a Russellian proposition.

In situation semantics the proposition expressed on an occasion is the interpretation of the sentence uttered with respect to the discourse situation and speaker connections. Interpretations are classes of situations, and situations are set theoretic constructs of individuals, properties and relations, and locations. If we attempt to draw the parallels with Richards' theory, we find that the primitives -- our basic constituents -- consist of more real world

entities in situation semantics. In both cases these constituents are composed into propositions (regarding abstract situations as propositions for the moment), but whereas for Richards this operation is openly recognised as linguistic, with Barwise and Perry it is said to be set theoretic.

The basic parallel raises the question of whether the set theory in situation semantics does not play a fundamentally linguistic role in replacing the explicitly linguistic structures of Richards' theory (and Fregean theories). Although the only explicit language is the object language, situations are theoretical and abstract entities that are composed out of things in the world put together in certain ways. The parts are held together in the world, although the way in which this is so puzzled Russell. Barwise and Perry do not have much to say about it in an illuminating way either (we are told that real situations are prior and that the parts are isolated as "uniformities" across real situations). In situation semantics the parts are put together set-theoretically, but the question arises as to what kind of structure the set theory embeds or encodes. This question is the topic for the next chapter, though it has been prowling around in the background since chapter three.

There is a matter that needs to be clarified: should we regard the proposition in situation semantics as an abstract situation or as a class of abstract situations (the interpretation of some utterance)? In many cases there will be one situation in the interpretation $_{d,c} \llbracket \varphi \rrbracket$ that is contained in all the other situations in $_{d,c} \llbracket \varphi \rrbracket$. Where this situation exists, call it the minimum situation. Since all the information in the interpretation can be extracted from the minimum situation (in a given model), the semantics could theoretically be redefined with respect to it, were it not for the problem that not every utterance has an interpretation that contains a minimum situation. For example, the interpretation of an utterance of a sentence containing a definite description has no minimum situation when the description is used attributively.

An example will make this point clear. The interpretation of an utterance of

- (7) The bravest warrior among the Achaeans has won the best prize of the games.

will contain more than one situation which is minimal. A situation in which Ajax is the bravest warrior among the Achaeans and where Ajax has won the best prize is in the interpretation; so is a situation where Achilles fulfils these conditions. More precisely, both e_1 and e_2 are in the interpretation:

$e_1 :=$ at \underline{l} : bravest-warrior-among-the-Achaeans, Ajax; yes

at \underline{l}' : winning, p , Ajax; yes

$e_2 :=$ at \underline{l} : bravest-warrior-among-the-Achaeans, Achilles; yes

at \underline{l}' : winning, p , Achilles; yes

where $\underline{l} \circ \underline{l}_d$, $\underline{l}' < \underline{l}_d$, and p is the best prize of the games (a referential use of the definite description, we may assume). Yet neither $e_1 \subseteq e_2$ nor $e_2 \subseteq e_1$, so the interpretation does not contain a minimum situation.

This feature -- that many interpretations do not have a minimum situation -- is deeply rooted in the semantics, in the way situations are defined. More specifically, it is rooted in the decision that situations should be abstract entities constructed out of actual individuals, relations and locations. To get at the proposition expressed or the statement made when a definite description is used attributively by saying that there is a unique something or other that is such and such (which is the conception of the proposition expressed when there is attributive reference in Richards' theory) is prohibited in situation semantics. Barwise and Perry never speak of a proposition of the form 'there is an x such that $F(x)$ ' -- perhaps this is a consequence of their revolt against the undue influence of formal logic on natural language semantics.

Essentially, Barwise and Perry are denying that the logical structure of an utterance of 'The \underline{D} is \underline{F} ', where \underline{D} is a definite description used attributively, is $(\exists!x)(\underline{D}(x) \ \& \ \underline{F}(x))$.¹² That is, they reject Russell's analysis of definite descriptions; they reject the idea that general propositions have a special form. Instead,

situation semantics specifies the proposition by requiring the class to contain the situations a is such and such, b is such and such, etc., where a, b, ... are all the individuals that satisfy the description. If this is correct and it is not the case that they have simply not yet dealt with general propositions in detail, Barwise and Perry intend Russell's general propositions to be represented in situation semantics by classes of abstract situations (classes of particular propositions).¹³

The state of the semantics -- any special form for general propositions being relinquished -- creates difficulties for thinking of propositions as single abstract situations. Without a special form for general propositions, we can only represent them through classes of abstract situations. Yet there is merit in the idea of an abstract situation corresponding to a proposition: if we were to add to the representational power of situation semantics, so that we could construct an abstract situation that would of itself specify that p, for p a general proposition, then the idea would be vindicated.¹⁴

To summarise this section on the relation between Richards' theory and situation semantics, we have found that Richards believes semantics should be narrow semantics and concern itself with reference, whereas Barwise and Perry believe that we should do wide semantics and give prominence to linguistic meaning. The notion of the proposition is central to Richards' semantics; in contrast, it is not clear that there are propositions in the 1983 version of situation semantics, or what they might be, but it seems that in certain circumstances abstract situations can be regarded as propositions. Finally, Barwise and Perry are going beyond Russell and Richards in employing not predicates, but rather real world properties and relations, in their semantics. Counting also the addition of locations, regarded as parts of the world, to situation semantics, Barwise and Perry have gone the entire way to constructing propositions out of pieces of the world.

Chapter Five: The Quasi-Linguistic Status of the Semantics

5.0 Introduction

Probably the most radical departure from tradition to be found in situation semantics is the claim that meaning is located in the world, independent of language. The aim of this chapter is to examine and evaluate this claim about situation semantics to discover whether the semantics as actually given vindicates the rhetoric, and, more generally, to ask in the process whether such a theory is possible at all. To anticipate results, our concern is to establish that Barwise and Perry have not achieved what they claim; that there is an irreducible linguistic or quasi-linguistic residue inherent in situation semantics.

We shall concentrate initially on abstract situations, the relation of their constituents, and on the role of the set theory that is employed to construct abstract situations. Then we shall consider the formal apparatus of abstract situations as a formal language which requires to be interpreted via model theory, thus treating it explicitly as a language, and investigating the consequences. Finally we shall apply the argument that motivated a recent extension of the theory by Robin Cooper to show that the theory must be extended further; the result of these extensions is to turn the level of abstract situations into a syntactic system.

5.1 The quasi-linguistic status of the semantics

5.1.1 Abstract situations displace real situations¹

Barwise's paper 'Scenes and Other Situations' is concerned with a certain kind of report -- what are called naked infinitive (NI) perceptual reports, after the form of the verb in the embedded

clause. To illustrate the kinds of report involved, (1) is a NI perceptual report, whereas (2) is not.

(1) Odysseus saw the Cyclops milk the ewes and goats.

(2) Odysseus saw that the Cyclops was milking the ewes and goats.

Barwise's analysis of (1) in his paper falls into two parts: firstly, he says there is a scene \underline{s} (a visually perceived situation) which Odysseus saw, and secondly, this scene supports the truth of 'The Cyclops milk the ewes and goats'.

(3) $\exists \underline{s}(\text{Odysseus sees } \underline{s} \ \& \ \underline{s} \in \llbracket \text{the Cyclops milk the ewes and goats} \rrbracket^M)$

This analysis reflects both the fact that Odysseus is causally affected by something in the world, the scene which he sees, and the fact that the scene, as part of the world, is important for determining the truth or falsity of the perceptual report. This conception of a scene supporting the truth of a sentence φ is 'the central notion in the theory'. (Barwise, 1981, p. 390)

At the time the early papers on situation semantics were written (Barwise, 1981; Barwise and Perry, 1981a, 1981b), Barwise and Perry thought there was a world, ie. a largest or total situation. (Later they change their mind about this: in Barwise and Perry (1983) the model theory leaves the existence of a world undecided and Barwise and Perry do not commit themselves one way or the other; in Barwise's more recent work (Barwise, 1984), the possibility of a world is explicitly excluded.) Situations were parts of this reality. At this stage in the development of the theory, therefore, situations are real situations, parts of the real world.² Barwise writes:

Any part of the way the world \underline{M} happens to be I call a situation in \underline{M} . Scenes are visually perceived situations. The central notion in the theory is that of a scene or other situation supporting the truth of a sentence φ in \underline{M} . (Barwise, 1981, p. 390)

The interpretation $\llbracket \varphi \rrbracket^M$ of a sentence φ is a collection of real situations; when Barwise gives examples of some scenes, they are parts of the world: for example, the scene in Barwise's office seen from under his desk.

Why is it that those situations which have the central role in the theory at this stage are real situations, but that later the central position is taken over by abstract situations? The crucial point is that in Barwise (1981), there is no analysis of the internal structure of situations; in fact Barwise explicitly acknowledges that one of the things that must be done to make his proposed semantic theory precise is to 'explain exactly how we represent situations' (Barwise, 1981, p. 391). Notice particularly the way scenes and situations are specified: thus, 'the scene seen from under the desk'.

Already, however, situations are understood in terms of what constitutes them: objects having properties and bearing relations to one another. Once the attempt is made to articulate the structure of situations -- by discerning their parts: individuals, relations and locations, -- the question of how these parts are related raises its head. Barwise and Perry use set theory to put the pieces of situations together, but what they produce by this procedure are of course abstract situations, not the things in the world they started out with. The switch to abstract situations is necessitated, significantly and interestingly, by the need to make accessible the internal structure of situations.

We have established that abstract situations have taken over the central role from real situations;³ but the question of the real nature of the structure possessed by these set theoretic entities remains in large part to be answered. On the surface it is a set theoretic structure; but the question we are urging is whether this set theoretical structure hides a fundamentally linguistic or language-dependent structure. In our evaluation of the truth of Barwise and Perry's claim to do semantics in terms of meanings and structures in the world, independent of language, we are interested in the possibility that some of the semantic entities to which they help themselves are perhaps after all linguistic, with the

consequence that their claim would be invalidated.

5.1.2 The setting and distinguished indeterminates

As basic indeterminates, the distinguished indeterminates **a**, **b**, **l** and **tv** of Aliass are all urelements of the set theory, and can therefore be any objects at all, except sets (either generated from other urelements or the empty set). What is meant by distinguished indeterminates? What sort of role do these indeterminates have in the semantics? According to the philosophical backdrop to situation semantics, meaning -- both linguistic and non-linguistic -- is claimed to exist in the world prior to language; but an examination of the role of these entities suggests the contrary view. So are they a means of covertly maintaining required linguistic structure in the semantics? We focus in this chapter on the question of whether the semantic entities in situation semantics have retained a quasi-linguistic character.

Ignoring the tense marker and polarity for simplicity, the sentences of Aliass have a certain grammatical structure, which consists of a relation symbol, a subject, and an optional object. The role of the indeterminates **a** and **b** is to act as place holders in the situation being constructed, until the semantic values of (respectively) the subject and, if present, the object can be entered. The function of these indeterminates can be seen more clearly if we think of the situation as being constructed from the components $\langle \underline{r}, \underline{a}, \underline{b} \rangle$, \underline{a} , and \underline{b} . I am here using a dynamic language and speak of the situation designated by an utterance as being constructed out of pieces contributed by the constituent expressions of the sentence; in effect, the utterance simply designates the situation $\langle \underline{r}, \underline{a}, \underline{b} \rangle$. Nonetheless, the dynamic view is supported by the idea behind the principle of compositionality, namely, to relate the interpretation of the whole to the interpretations of the parts.

The role of **a** and **b**, and indeed of the other distinguished indeterminates, is not to determine what any of the constituent

expressions designate, nor, ultimately, what the whole sentence designates. Rather, expressed dynamically, their function is a compositional one, to operate in the process of constructing the interpretation of the whole from the interpretation of the parts. The setting has a similar function; in fact, the roles of these two kinds of entity -- setting and distinguished indeterminate -- are not only linked, but are essentially one. Neither has a semantic role: they have the function of operating together to ensure that the interpretations of expressions are put together in the right way in constructing the described situation. 'In the right way' means, of course, that, respectively, the structure of the described situation and the particular way that that structure is instantiated, are parallel to and matched by the logical structure of the sentence uttered and the particular expressions that have those grammatical roles.

Distinguished indeterminates are potential members of the SCats of expressions; they function by being incorporated into the interpretations of relation symbols (eg. a in $\langle r, a, b \rangle$) and by being mapped to parts of the world (or a truth value) by the setting, so that as place holders they "pull" that part of the world into a specific location in the structure being built (thus, if $a_s = j$, $b_s = m$, the situation $\langle r, j, m \rangle$ gets built, and not $\langle r, m, j \rangle$ or $\langle j, m, r \rangle$). The setting, in mapping the indeterminates to parts of the world, is able to coordinate the interpretations of the parts and ensure that the interpretation of the whole is correctly constructed, but only because each indeterminate has a special function, which it derives solely from the compositional rules; namely, a is associated with the subject, b with the object, etc. The function of the two kinds of entities are linked; setting and distinguished indeterminate perform their task together.

Having seen that the setting and distinguished indeterminates have no referential role, but rather control the way things are put together through their mutual action, the question we need to ask is: What is the nature of the structure that the setting and the distinguished indeterminates together specify? In other words, we

are asking about the nature and status of abstract situations in the theory.

We shall begin with this question by considering one aspect of abstract situations. It is important that the building blocks, ie. the interpretations of the parts of an utterance, are combined appropriately, but why does this matter? Consider an utterance of the sentence 'Jackie is biting Molly', which designates the abstract situation $\langle \underline{l}, \langle \underline{r}_p, j, \underline{m} \rangle, 1 \rangle$. The five elements we obtain, four pieces of the world and the truth value according to situation semantics, could have been combined set theoretically in other ways. Most of these would simply not be situations, but there is one that is: $\langle \underline{l}, \langle \underline{r}_p, \underline{m}, j \rangle, 1 \rangle$. Abstract situations are set theoretic entities, and these two sets are distinct, therefore these two abstract situations are distinct. The role of the setting and the distinguished indeterminates is to ensure that the first abstract situation is assigned to the utterance of the sentence, and not the second.

The setting and the distinguished indeterminates have the role of constraining a set theoretic structure, for the formal structure of abstract situations is set theoretic. Abstract situations were introduced, we were told, to classify real situations. Intended as tools with which the theorist can model the world, their structure, while formal, is intended to capture the structure of real situations that is important to language using organisms, namely ourselves. Although some would say that it is specifically our cognitive abilities that enable us to divide the world into objects having properties and standing in relations to one another, Barwise and Perry take the ecological view, that the organism perceives such and such structure in the world only because it is there in the first place to be perceived. They speak of the 'duality' between the cognitive states of the organism and the environmental structure external to the organism. This structure, which is out there in the real world (on the ecological and situation semantics views), and which is apprehended by organisms, is basic or fundamental for Barwise and Perry; it is what they want to model with the set

theoretic structures of their semantics (abstract situations).

The utterance conveyed information about Jackie, the same information that was conveyed to the vet by the X-ray, that her leg was broken. Information can be carried by language but information is not language; in fact, information is prior to language. [...] If our theory of language is going to capture this ability of utterances to convey a piece of information we must have the information there to be conveyed. (S&A, p. 29)

The set theoretic nature of abstract situations is incidental -- it just happens that set theory has been used extensively as the basic means of expressing or formulating mathematics (although it seems that this foundational role is now beginning to be taken over by category theory⁴).

Barwise and Perry want us to view the set theoretic structures of the semantics merely as convenient tools that are used to model and classify the structure (information) that is already there in the world. While it is true that abstract situations are introduced amidst a lot of talk that they will be used to "classify" real situations, hardly have they been introduced than they usurp the central role of the theory, and real situations are relegated into obscurity. The classificatory, modelling and representational aspect of abstract situations is soon overshadowed, and we focus on abstract situations as entities in themselves. They have ceased to represent anything, certainly not real situations, and they, not real situations, have a semantic role. Being forced, therefore, to attend to abstract situations as objects in their own right, we find our attention thrust back upon that same formal, set theoretic structure. We can no longer regard it merely as a tool for modelling or classifying structure that is out there in the world, for it has itself become the object of our attention.

What has happened is just the same story as happened with Moore and Russell. Initially, the idea is to locate propositions, or meaning, or semantic structure in the world, independent of language, later one is forced to retreat from this position. We have already indicated how this took place with Moore and Russell: essentially it

was the problem of false propositions and false belief. With Barwise and Perry, the initial emphasis on real situations, as for example in Barwise (1981), gives way to abstract situations, abstract entities not in the world.

It is important to realise that we are not being forced to take up a position on whether fundamental mathematical concepts, whether those of set theory or category theory, and more particularly, Barwise and Perry's set theory, are essentially linguistic in origin or whether they represent a non-linguistic faculty of the human cognitive apparatus. That interesting question is irrelevant to our present interests. We are not asking about the nature of the mathematics, but about the use to which it is put in the semantic theory.

We must be clear also on the question of where the structure we are talking of is actually located. On the ecological view, the same structure both exists in the world and is present in the organism's cognitive activity (an idea expressed by the notion of the organism-environment duality). Barwise and Perry claim that linguistic structure, which they model by means of abstract situations, is the structure in the world. Unlike the real situation, however, where the constituent pieces fit together quite naturally and of themselves, the way in which the pieces are combined when the abstract situation is built up -- by means of the set theory -- must be subject to constraints to ensure that the right result is obtained. The source of these constraints is the syntax of the object language. The structure represented by the theoretical entities -- abstract situations and their constituents, considered as elements of abstract situations, -- therefore "inherits" a syntax from the object language.

Our aim has been, firstly, to point out that abstract situations have a syntax, and secondly, to show that the structure represented by abstract situations is also syntactic. Since the world is not syntactical, we must then conclude that there is a gap between abstract situations and the world, one which discredits Barwise and Perry's claim about the status of meaning and

information.

An illustration from physics at this point should clarify the matter. The relation between abstract situations and real situations may be compared to that between our theory of planetary revolutions and the situation of Jupiter orbiting the sun. In each discipline, semantics and physics, one member of the pair is part of the world (real situations and the situation of Jupiter's orbit, respectively); and the other member (abstract situations and our theory of planetary revolution) is part of our theorising about the respective piece of the world. This is what Barwise and Perry expect us to think of the relation between abstract situations and real situations. The problem for them and their claim that meaning is in the world, however, is that this is not the situation with the theory as actually developed and practised.

In the physical case we are dealing with both laws formulated in the theory and the corresponding features of the real world -- that matter, or the world in general, behaves in such and such a way. The latter is just the fact of the world's being the way it is; the former is our expression of this property of the world within a theory, and that expression requires language -- but this does not make the world linguistic, of course. Similarly, real situations have a certain structure (that Jackie is biting Molly, for example), and abstract situations represent this structure by having a syntactic structure of their own. The difference between the two cases lies in the fact that the object of the theory in situation semantics is, as we have shown, not the level of real situations, but that of abstract situations. Meaning and interpretation in Barwise and Perry's formal theory, instead of being in the world, are just formal structures, requiring syntactic constraints on their combination. These constraints originate with the syntax of the object language. Because the level of abstract situations requires such constraints, derivative on linguistic structure, situation semantics fails to satisfy the conditions for strong compositionality and is only weakly compositional.

5.1.3 The language-dependent nature of Fregean semantics

For purposes of comparison in our exploration in this central and crucial question, let us consider Fregean theory and the way in which it integrates language into its view of meaning; we can then reconsider the role of the set theory in situation semantics. We shall consider a sentence Ft , consisting of a monadic predicate F and a singular term t .

Frege's philosophy of language begins with the choice of the sentence as the unit of analysis and of truth as the fundamental property of sentences, in terms of which the semantics is worked out. For Frege the reference of a term is an individual, and the reference of a predicate is its extension, the collection of all individuals that have the property. Each of these expressions also has a sense. The sense of a term is a common or public way of thinking of the individual associated with the term, a mode of presentation of the individual. The sense of a predicate is more difficult to specify, but is that which determines its extension -- which we may think of as the concept of its extension.

Fregean semantics was developed by Carnap and Church with the tools of intensional logic to represent the senses and references of expressions. This theory assigns an individual concept to a term as its sense -- a function which when evaluated at a possible world will determine the reference, which is an individual in the domain of interpretation of the model. A predicate is assigned as its sense a function which, given a world, determines the extension of the predicate at that world, the extension usually being represented as a set of individuals (or the characteristic function of this set).

But which set? Well, precisely the set of individuals which satisfy the predicate. The references of predicates in the Fregean theory are not things in the world, independent of language: we cannot define the set that is assigned as the reference of the predicate F independently of the predicate itself; we have to say that $\llbracket F \rrbracket = \{a \mid a \text{ satisfies } Fx\}$. This is not a circular definition: we are defining the reference of F , not in terms of itself (namely

$\llbracket \underline{F} \rrbracket$), but in terms of the predicate \underline{F} , thereby displaying the language-dependence of the Fregean concept of meaning. The interpretation function assigns to \underline{F} a set, which is by definition the set of all objects that satisfy the open formula $\underline{F}x$. What we should notice is that we cannot separate the reference of \underline{F} -- something we might like to think of as part of the world, if our philosophical view were so inclined -- from the predicate itself: definition or specification of the reference is irreducibly language-dependent. The Fregean approach, then, differs from situation semantics in respect of what it takes as being in the world; it regards individuals as in the world, but stops short at properties.

Let us try to grasp more firmly the sense and reference of the predicate \underline{F} by considering its contribution to the proposition expressed by the sentence $\underline{F}t$. The sentence consists only of two basic expressions, \underline{F} and t , the term contributes to the proposition the concept determining the individual object; hence the predicate must contribute everything else. Michael Dummett expresses this:

The sense of an expression has been explained as that ingredient of its meaning which is relevant to the determination as true or false of a sentence in which it occurs: we can now say that it is that ingredient of its meaning which determines the semantic value of the expression. (Dummett, 1978, p. 121)

The sense of the predicate is basically the proposition expressed by $\underline{F}t$ minus the individual concept, for when we add the individual concept, contributed by t , to the sense of \underline{F} , we get the proposition expressed by $\underline{F}t$. Whatever this strange entity is -- a proposition with a piece missing, with a hole, -- it cannot be something that exists in the world independently of language.

With the Fregean theory we have to work at the level of sense, identifying propositions with senses of sentences, since the reference of a sentence is a truth value, not a proposition. Frege regarded the sense of a sentence as the thought expressed (Frege, 1956, p. 292), and this means nothing other than the proposition expressed. The sense of the predicate is a proposition with a hole.

What about the term? For the pure Fregean theorist, there are no singular propositions; the sense of a singular term is an individual concept which may be thought of as something that picks out an individual. Although the individual concerned may be picked out by a description, for example, the individual, as a member of the domain of interpretation, is taken to be an already existing object, a part of the world. In possible world formulations the individual concept is represented by an intension, a function which for each possible world w provides us with an individual a_w from among the individuals that exist in w (if a suitable individual exists).

In Russellian semantics, which allows singular propositions, we can "pull out" all individuals that are constituents of a singular proposition. Propositions have some structure -- the proposition expressed by 'Jackie is biting Molly' on an occasion is not the same as that expressed by the sentence 'Molly is biting Jackie' (on the same occasion): this is the structure that Barwise and Perry capture in the set theoretic notion of a sequence. This parallelism in structure between propositions and sentences suggests that propositions are very like linguistic entities -- though rather strange ones, since their constituents include real world individuals. I should say in passing that Richards' work is a formulation of this very picture.

The introduction of singular terms and singular propositions by adding these Russellian notions into the basic Fregean framework is Kaplan's development. In his theory a singular term t determines the relevant individual at the context of utterance. A sentence only expresses a proposition when taken relative to a context, and a singular proposition is composed out of the individual and the sense of the predicate, which is a function from possible worlds to extensions.

In the Fregean theories individuals, but not properties, are given independently of language. Moreover, there is no semantic mechanism for specifying situations ie. parts of the world. Richards has predicates, not properties, in his theory with which he constructs propositions, but these entities are not in the world.

That we get a hold on the senses and references of predicates and sentences by means of language is what is rejected in situation semantics by the claim that all of meaning is in the world and the consequent attempt to do semantics with properties as primitives. We have seen some of the problems Barwise and Perry face in attempting to locate meaning in the world, and have seen, too, that the set theoretic apparatus employed in situation semantics still requires a necessary role for linguistic or syntactic structure in the theory of meaning. We shall now attend more carefully to the question of whether there is anything to Barwise and Perry's claim to be using the set theory in a classificatory role in their semantics, or whether in the definition and specification of interpretations it really does take over the function performed by language in standard theories.

5.1.4 On the alleged classificatory nature of abstract situations

The primitives of situation semantics are individuals, properties, locations and indeterminates; abstract situations and situation types are constructed from these. Lest we think, however, that Barwise and Perry see their primitives as corresponding to the basic constituents of the world, we are told that the world consists of (real) situations -- that such situations are metaphysically and epistemologically basic, and that the primitives arise as "uniformities" across real situations. These primitives are the urelements of a constructive set theory (Kripke-Platek admissible set theory with urelements, or KPU), abstract situations being identified with certain sets thus generated. Some abstract situations are intended to be seen intuitively as 'counterparts' of real situations, and the entire apparatus of abstract situations is intended as a means of classifying real situations. But what exactly does classification mean in this context?

At one point we are told that there is a relation classifies that holds between abstract and real situations; this requires us to

see Barwise and Perry's semantics -- the classificatory apparatus of abstract situations, event types, etc. -- as a part of the world and pieces of it as bearing the relation classifies to other parts of the world; at least this is so if we view classifies as a relation in the world, which it seems to be.

[...] we suppose that there is a nonempty collection E_0 of real situations and a relation classifies that holds between abstract courses of events, on the one hand, and real situations, on the other. Objects, relations, and locations provide the connection between real situations and abstract situations. They are uniformities across the former and constituents of the latter. Intuitively, e classifies e if and only if

if, in e , at l , r , a_1, \dots, a_n ; yes,

then, in e , at l , a_1, \dots, a_n stand in the relation r ;

and

if, in e , at l , r , a_1, \dots, a_n ; no,

then, in e , at l , a_1, \dots, a_n do not stand in the relation r .

And we say that e is factual if it classifies some real situation e . (S&A, p. 61)

There is a sense in which abstract situations are parts of the world, similar to the sense in which numbers and, more generally, abstract mathematical objects are. More precisely, abstract situations are in the world because they are part of our world: our theorising is as real as our literature and music. But this idea of being in the world is confusing, for we meant more than this by our question about the status of Barwise and Perry's semantic entities. We are not presently engaged in philosophy of mathematics, we are not asking which mathematical objects exist, and in which sense.

Abstract situations are neither names nor labels for real situations; many abstract situations do not correspond to any real situation, so there is nothing for them to name. They seem rather to constitute a duplicate or surrogate world, but, significantly, a more flexible one. Objects, relations and locations are constituents of abstract situations, and can be put together in specific ways that are non-factual, ways in which they are not related in real

situations. Even if we have correctly identified parts of real situations, we do not know how they are put together in those situations; in contrast we know exactly what the relation between an abstract situation and one of its constituents is: it is a set theoretic relation. The relation between an abstract situation and a part of it is not "in the world" in the sense that is relevant to our inquiry; it is a completely different composition of parts from that which holds in reality.

An abstract situation has parts of the world as its constituents,⁵ these parts being held together in some structured way, which is in fact accomplished by means of the set theory. The apparatus of abstract situations is part of a theory -- a semantic theory -- and as such accepts a representational or modelling status. Given this representational status of situation semantics as a theory, it is natural to consider whether the set theoretic nature of the operation of holding constituents together within abstract situations stands for itself, or represents something else.⁶

In this chapter, and to some extent in chapter three, we have been trying to show that the level of abstract situations in situation semantics has a quasi-linguistic status. The property of language that interests us is that it is symbolic; expressions represent something, have meaning -- they refer to something beyond themselves. Comparing situation semantics with physics, Newton's third law of motion, to take that example, is formulated as

$$\underline{F} = \underline{ma}$$

and this equation has a meaning (Bedeutung), since the equation is a linguistic expression. The meaning, however, is something in the world, a feature of the way the world behaves. An expression from a paper on situation semantics is similarly linguistic and also has a meaning: thus

e:= at l: biting, Jackie, Molly; yes.

The meaning (Bedeutung) in this case is a specification of the abstract situation e, a set theoretic entity, which is part of the

world in the sense that abstract objects exist as part of the furniture of the world (which we are allowing). But the abstract situation e has another role as a theoretical object: it is part of the apparatus of abstract situations which as a totality represents the states of the world -- the real situations. The level of abstract situations is not a part of the world qua something with a theoretical and symbolic role: there is a difference between the physical and situation semantics cases.

Barwise and Perry talk of abstract situations 'classifying' real situations; it is true that we cannot regard every individual abstract situation as representing some real situation, since there are many more abstract situations than real situations, and this state of affairs disguises the representational status of abstract situations. Nonetheless, as we saw in section (5.1.1), the level of abstract situations displaces the real world and, as a whole, functions as a surrogate level representing real situations.

We conclude, therefore, that the relation between the level of abstract situations and the world is identical to that between a language and the world: it is one of representation rather than "classification". The set theoretic "glue" is essentially a linguistic holding-together of the constituents of abstract situations. To carry forward this idea I shall consider treating the apparatus of situation semantics as a formal language with an interpretation.

5.2 Situation semantics as an interpreted language

In his (1974) Barry Richards defined a family of languages where the terms (more exactly, the individual constants) can be any kind of object in the world. In Richards (1976), where there is a similar semantics, this device, the technique of Henkin-style completeness proofs of letting the domain of interpretation be the set of constants of the language, is adopted in providing a formal semantics for adverbs. These cases of identifying objects in the

world and expressions of a language (although a certain restricted class of expressions) are suggestive in the present context of whether there is a quasi-linguistic element to the structure of abstract situations. Could we similarly define a family of languages where not only individual constants but other expressions as well are at the same time entities in the world?

I shall now construct a family of languages with a semantics on similar lines. The languages are to be defined in such a way that sentences of the languages correspond to abstract situations. Thus we shall have properties and locations as actual basic expressions of the languages, in addition to individuals (Richards' strategy), since these real world entities are the primitives which situation semantics adds to standard model theory. The atomic predicates of the languages will therefore actually be the properties of situation semantics, the things that are part of the world; and the location markers of the languages (instances of the grammatical category Loc) will be the space-time locations of situation semantics. And, of course, the individual constants will be the individuals from situation semantics. Closed well-formed formulae of the formal languages which I shall define are intended to be regarded as corresponding to the abstract situations of situation semantics, in virtue of the identity of the constituents of each.

The aim of this exercise is to help uncover the real status or nature of abstract situations. Barwise and Perry have claimed that they are abstract, mathematical entities that are used to classify real situations. Fundamental to their semantics is the idea that meaning is in the world: that although meaning is connected with linguistic expressions (both expressions and mental states have meanings, but are not themselves meanings -- Barwise and Perry, 1983, p. 7), yet meaning itself is essentially non-linguistic in nature. If this claim about linguistic meaning were true, it would be possible to study meaning using abstract situations, but without reference to language, except in so far as to keep in mind that linguistic expressions have these individual meanings and have also particular designations on occasions. That is, the realm of meaning

should be capable of being treated autonomously, even though particular meanings are related to expressions of the language. The study of meaning would be identical in this respect to physics or chemistry; theorising would be carried out in language (of course), but there would be nothing linguistic about the objects of study. Importantly, if meaning is in the world, composition of meanings should be definable wholly within the realm of meaning and without reference to language. On this picture there is an isomorphism between the realm of language and the realm of meaning -- but this is possible only because meaning is autonomous.

In this chapter we are seeking to discover whether, in the semantics as given, abstract situations and relations between abstract situations (meanings) are, or even could be, defined independently of language; we propose to carry this investigation forward by considering the points that arise when we explicitly treat the tools of situation semantics as expressions of a formal language. With this strategy we shall pursue the idea that abstract situations cannot be regarded as mathematical entities classifying real situations and thus operating with parts of the world and meaning in the world, but should be conceived as sentences expressing propositions, or as pictures or representations of real situations, thereby betraying their fundamentally symbolic status.

5.2.1 Syntax

The family of languages $\mathbb{L}(\mathcal{L}, \mathcal{R}, \mathcal{X})$ will be defined in such a way that the structure of sentences of individual languages parallels the structure of abstract situations. An atomic sentence will correspond to a situation that has only one thing happening at one location -- only one relation is specified to hold of the appropriate number of objects; "larger" situations, those that specify two or more relations as holding, will correspond to molecular sentences. The languages each have the following grammatical categories: S (sentence), Term, for each natural number n , RS^n (n -place relation

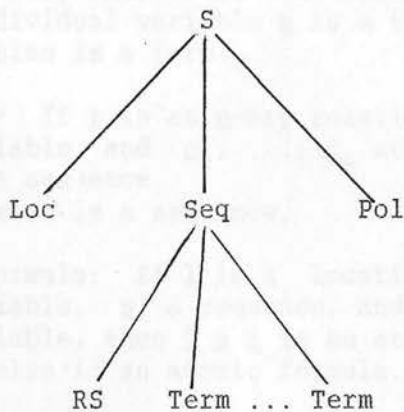
symbol), Seq (constituent sequence), Loc (location marker), and Pol (polarity or truth value). All atomic sentences are generated by the phrase structure grammar:

$$S \rightarrow \text{Loc Seq Pol}$$

$$\text{Seq} \rightarrow \text{RS}^n \underbrace{\text{Term} \dots \text{Term}}_{n \text{ instances}} \quad (n = 0, 1, 2, \dots)$$

n instances

The terminal categories are: Loc, RS^n ($n = 0, 1, 2, \dots$), Term and Pol; S and Seq are grammatical categories. An atomic sentence will therefore have the structure:



A sentence $\underline{l} \ \underline{r} \ \underline{a}_1 \ \dots \ \underline{a}_n \ 1$, to take an example, will accordingly express the proposition that the relation \underline{r} holds among the individuals $\underline{a}_1, \dots, \underline{a}_n$ (in that order) at the location \underline{l} . We shall think of this sentence as expressing the proposition (in the situation semantics sense, ie. a class of abstract situations) of which $\langle \underline{l}, \langle \underline{r}, \underline{a}_1, \dots, \underline{a}_n \rangle, 1 \rangle$ is the minimum situation, that is, the proposition $\{ \underline{e} \mid \langle \underline{l}, \langle \underline{r}, \underline{a}_1, \dots, \underline{a}_n \rangle, 1 \rangle \in \underline{e} \}$. If \underline{S}_1 and \underline{S}_2 are sentences, we can form another sentence, written $\underline{S}_1 \ \& \ \underline{S}_2$, which corresponds to the situation $\underline{e} = \underline{e}_1 \cup \underline{e}_2$, where \underline{S}_j corresponds to the situation \underline{e}_j ($j = 1, 2$).⁷

A rigorous definition of these languages and their semantics now follows. Formally, a language is determined by disjoint sets \mathcal{L} , \mathcal{R} and \mathcal{X} , where, from the point of view of the language, \mathcal{L} is the

set of individual constants, \mathcal{R} is the set of relation symbols, and \mathcal{L} is the set of location markers.⁸ As pointed out above, these sets will be chosen, in the specific case, so that the set \mathcal{C} of individual constants is a subset of the class of individuals from situation semantics; the set \mathcal{R} of relation symbols is a subset of the class of relations from situation semantics; and the set \mathcal{L} of location markers is a subset of the class of space-time locations from situation semantics. We also employ the truth values (polarities) 0 and 1, and have available an infinite number of variables of each atomic kind.⁹

The formation rules for a language $\mathcal{L}(\mathcal{C}, \mathcal{R}, \mathcal{L})$ are as follows:

Term: Every individual constant $c \in \mathcal{C}$ is a term;
Every individual variable x is a term;
Nothing else is a term.

Sequence: If r is an n -ary relation symbol or n -ary relation variable and c_1, \dots, c_n are n terms, then $r c_1 \dots c_n$ is a sequence.
Nothing else is a sequence.

Atomic formula: If l is a location marker or a location variable, s a sequence, and i a polarity or a polarity variable, then $l s i$ is an atomic formula.
Nothing else is an atomic formula.

We define the (molecular) formulae of a language $\mathcal{L}(\mathcal{C}, \mathcal{R}, \mathcal{L})$ as follows:

(Molecular) formula: Every atomic formula is a formula.
If s and s' are formulae, then $(s \ \& \ s')$ and $(s \ \vee \ s')$ are formulae.
Nothing else is a formula.

We shall use punctuation, '(' and ')', on an informal basis when it helps to clarify the syntax.

We do not have quantification of any kind in these languages: the 1983 theory allows us to state only particular or definite propositions (statements), not general propositions, without invoking classes of situations. The 1984 theory, which employs situation types as the central notion, involves implicit quantification; we could make this explicit, adding existential and universal

quantifiers to the languages $\underline{L}(\mathcal{L}, \mathcal{R}, \mathcal{Z})$.

An assignment \underline{s} for a formula \underline{S} is a function which assigns to each variable an entity of the appropriate kind; thus \underline{s} assigns to each individual variable in a formula \underline{S} an individual constant, to each location variable in \underline{S} a location marker, to each polarity variable in \underline{S} a polarity, and to each relation variable in \underline{S} a relation symbol. We shall allow assignments to be partial with respect to the set of all variables: to be an assignment for a given formula, \underline{s} is required to be defined only for those variables occurring in the formula. Assignments therefore turn out to be total anchors. We shall write $\underline{S}[\underline{s}]$ for the formula resulting from \underline{S} when each variable in \underline{S} is replaced by the value \underline{s} assigns to it. Note that $\underline{S}[\underline{s}]$ will always be a closed formula when \underline{s} is an assignment for \underline{S} .

5.2.2 Semantics

A sentence in the object language -- perhaps English or Aliass -- expresses a proposition when uttered in a situation $\underline{d}, \underline{c}$. Barwise and Perry have made it easy for us to see what propositions are; utterances describe states of the world, or what the sincere speaker takes to be the state of the world. States of the world are known as situations, and on Barwise and Perry's ontology situations consist of objects having properties and standing in relations to one another. We shall understand propositions in terms of this internal structure to situations. Thus the proposition expressed by an utterance would be to the effect that a certain object has a certain property, or that certain objects stand in a certain relation, at a location.¹⁰ An utterance of

(4) Jackie is biting Molly.

would express the proposition that Jackie stands in the relation of biting to Molly at a location that overlaps the discourse situation.

The sentences (closed formulae) of a language $\underline{L}(\mathcal{L}, \mathcal{R}, \mathcal{Z})$ also

express propositions. A sentence $\underline{l} \underline{r} \underline{a} \ 1$ expresses the proposition that \underline{a} has the property \underline{r} at the location \underline{l} ; a sentence $\underline{l} \underline{r} \underline{a} \ \underline{b} \ 0$ expresses the proposition that \underline{a} does not bear the relation \underline{r} to \underline{b} at the location \underline{l} ; and so on.

A model for a formal language $\underline{L}(\mathcal{L}, \mathcal{R}, \mathcal{Z})$ is an ordered pair $\mathcal{M} = \langle \underline{X}, \underline{V} \rangle$, where $\underline{X} = \mathcal{L} \cup \underline{Y}$, the union of the set \mathcal{L} of individual constants with the set \underline{Y} of all sentences of \underline{L} , and \underline{V} is a function which assigns to each n -place relation symbol \underline{r} , a subset $\underline{V}(\underline{r})$ of $\mathcal{Z} \times \underline{X}^n$ (\mathcal{Z} is of course just the set of location markers). Truth in the model is defined recursively:

(M1) If \underline{r} is an n -place relation symbol,

$\underline{c}_1, \dots, \underline{c}_n$ are n terms, and \underline{l} is a location marker,
then

$\mathcal{M} \models \underline{l} \underline{r} \underline{c}_1 \dots \underline{c}_n \ 1$ if $\langle \underline{l}, \underline{c}_1, \dots, \underline{c}_n \rangle \in \underline{V}(\underline{r})$;

otherwise $\mathcal{M} \not\models \underline{l} \underline{r} \underline{c}_1 \dots \underline{c}_n \ 1$.

$\mathcal{M} \models \underline{l} \underline{r} \underline{c}_1 \dots \underline{c}_n \ 0$ if $\langle \underline{l}, \underline{c}_1, \dots, \underline{c}_n \rangle \notin \underline{V}(\underline{r})$;

otherwise $\mathcal{M} \not\models \underline{l} \underline{r} \underline{c}_1 \dots \underline{c}_n \ 0$.

(M2) If \underline{S} and \underline{S}' are closed formulae of \underline{L} ,

$\mathcal{M} \models \underline{S} \ \& \ \underline{S}'$ if $\mathcal{M} \models \underline{S}$ and $\mathcal{M} \models \underline{S}'$;

otherwise $\mathcal{M} \not\models \underline{S} \ \& \ \underline{S}'$.

$\mathcal{M} \models \underline{S} \ \vee \ \underline{S}'$ if $\mathcal{M} \models \underline{S}$ or $\mathcal{M} \models \underline{S}'$;

otherwise $\mathcal{M} \not\models \underline{S} \ \vee \ \underline{S}'$.

Notice that truth for \underline{L} is a property of sentences, not utterances: we have lost the property of efficiency, which both natural language and Aliass have.

Consider now a particular language $\underline{L}(\mathcal{L}, \mathcal{R}, \mathcal{Z})$, with Jackie and Molly in \mathcal{L} and the relation of biting in \mathcal{R} . Since the discussion will be carried out entirely at the metalevel, I shall use

metalinguistic names ' j ', ' m ', and ' r_B ' respectively for the above mentioned real world entities, so that $\underline{l} \ r_B \ j \ m \ 1$ is a sentence of \underline{L} . The proposition expressed by an utterance of (4) at $\underline{d}, \underline{c}$ is also expressed by the sentence $\underline{l} \ r_B \ j \ m \ 1$ of $\underline{L}(\mathcal{L}, \mathcal{R}, \mathcal{X})$ under interpretation by a suitable model \mathcal{M} . We shall follow Richards in regarding the sentence $\underline{l} \ r_B \ j \ m \ 1$ of \underline{L} not merely as expressing the proposition, but as a representation of that same proposition. According to the semantics that has been given, this proposition is true in the model $\mathcal{M} = \langle \mathcal{X}, \mathcal{V} \rangle$ if $\langle \underline{l}, j, m \rangle \in \mathcal{V}(r_B)$.

5.2.3 The attitudes

Since much of our interest concerns the semantics of the attitudes, we want to be able to represent the propositions expressed by sentences that report attitudes; (4) is a syntactically simple sentence. Thus, we need to ensure that the definition of the formal languages can be regarded as embracing the tools used in situation semantics to deal with the attitudes.

The initial idea in situation semantics was to handle attitude reports by treating eg. belief as a relation between the agent and abstract situations. Thus

(5) Ralph believes that Ortcutt is a spy.

would, if uttered truly, convey the information that Ralph was belief-related to situations in which Ortcutt is a spy, and not belief-related to situations in which Ortcutt fails to be a spy. This attempt for a semantics of the attitudes, chronicled in the ninth chapter of Barwise and Perry (1983), fails, the authors tell us,¹¹ essentially because it makes no reference to our mental states, whereas folk psychology, which natural language reasonably reflects, does make this reference. A proper treatment requires incorporating mental states into the theory, so schemata and anchors are introduced and employed to represent mental states and capture the relevant constraints and generalisations.

Let us suppose that Ralph's belief is de re and the speaker uttering (5) is aware of this. We may, if we choose, assume further that Ralph knows who Ortcutt is; he is aware that Ortcutt leads a double life, simultaneously holding the office of mayor and spying for a foreign power. The utterance of (5) describes a situation e in situation semantics just in case

(6) in e: at l: B_r, Ralph, S; yes
of, a, Ortcutt; yes

where l = c(believes), d, c [[Ralph]] Ralph, d, c [[Ortcutt]] Ortcutt, S = { E },¹² and

E := at h: spy, a; yes.

We need therefore to ensure that our formal languages can represent indeterminates, event types, schemata and anchors.

The definition of the languages $\underline{L}(\mathcal{B}, \mathcal{R}, \mathcal{L})$ already allows the kind of formulae that correspond to event types as sentences of \underline{L} , and no further apparatus is needed, because the indeterminates of situation semantics correspond to the free variables of the languages $\underline{L}(\mathcal{B}, \mathcal{R}, \mathcal{L})$ as presently defined. In fact, precisely the open sentences (ie. formulae with free variables) of \underline{L} correspond to the event types of situation semantics. This is clear from the observation that variables and indeterminates perform the same functions: they identify the type of entity (individual, relation, etc.) occurring at a certain place in a structure, but do not specify which entity: that question is left open. (As no utterance of an indicative sentence describes a situation type in the 1983 version of the theory, we need to make some modification to the grammar to factor out open sentences of \underline{L} as ungrammatical: in the example above, the open sentence correlated with the schema S is not a grammatical sentence in isolation, but the sentence correlated with e, of which it is a subsentence, is grammatical.¹³)

The situation type above corresponds to the open formula h spy x 1 of $\underline{L}(\mathcal{B}, \mathcal{R}, \mathcal{L})$, where the sets indexing \underline{L} are appropriately

chosen for the example.¹⁴ Schemata are sets of situation types; since we are using operations on linguistic expressions to do at least some of the tasks for which Barwise and Perry use set theory, I introduced the sentence connective \vee when defining the languages $\mathcal{L}(\mathcal{L}, \mathcal{R}, \mathcal{X})$ to represent this grouping of situations or situation types into a set. Since \underline{S} is here a singleton, however, the sentence corresponding to \underline{E} also corresponds to \underline{S} . (This is nothing to worry about, since singletons and their members are sometimes identified.)

Barwise and Perry often write the facts about the anchoring of indeterminates as part of the situation described. This is because if e_0 is a situation in which an agent a is belief-related to another situation e' , then representing the belief as

in e_0 : at \underline{l} : $\underline{B}_T, a, \underline{S}$; yes

where there is an anchor \underline{f} such that $\underline{S}[\underline{f}] \subseteq e'$, would be incomplete unless the anchoring facts are also part of e_0 . Thus, in (6) 'of' denotes the relation that holds between an indeterminate x and the object $\underline{f}(x)$ it is anchored to.

We can now say which sentence of $\mathcal{L}(\mathcal{L}, \mathcal{R}, \mathcal{X})$ corresponds to the situation e of (6); written out in full, it is

$\varphi = (\underline{l} \underline{B}_T \text{ Ralph } (\underline{h} \text{ spy } \underline{x} \ 1) \ 1) \ \& \ (\underline{l} \text{ of } \underline{x} \text{ Ortcutt } 1).$

There are occurrences of variables in this formula, which, as a sentence corresponding to what Barwise and Perry write and speak of as an abstract situation (although it contains indeterminates and schemata) is supposed to be a closed sentence. Let \underline{s} be the assignment which maps the individual variable \underline{x} to Ortcutt and maps the location variable \underline{h} to \underline{l} . The sentence $\varphi[\underline{s}]$, which contains locations and individuals replacing the variables in φ , makes no sense, for it contains the subsentence

$\underline{l} \text{ of Ortcutt Ortcutt } 1$

The relation 'of' is meaningful only when it holds between a variable and an individual constant.

Since we cannot really consider indeterminates and schemata as parts of the world, we cannot really have a situation here, although Barwise and Perry seem to think they do. If we applied the anchor to all indeterminates, the result would still not be a situation, for it contains the relation B_x , which now relates the agent to a set of situations, but cannot be a part of the world, unless we think of abstract situations as in the world -- which we hesitate to do. The fact is that abstract situations are constructed out of pieces of the world: individuals, properties, and locations; an entity which is constructed in the appropriate manner out of pieces of the world and abstract, constructed entities is not a situation.

5.2.4 Conclusion

At the beginning of this section I said that the aim was to uncover the real nature of abstract situations; we have now shown that it is possible to define a language which parallels the level of abstract entities of situation semantics. (Although we actually defined a family of languages, we would ultimately choose just one of these for doing semantics -- $\underline{L}(\mathcal{B}, \mathcal{R}, \mathcal{L})$ with \mathcal{B} identical to the class of individuals from situation semantics, \mathcal{R} identical to the class of properties, and \mathcal{L} equal to the class of locations.) The parallelism means that we can regard either the language \underline{L} or Barwise and Perry's presentation of abstract situations, situation types, etc. as equally representative of the essence of at least the formal theory of situation semantics.

We can tease out the result of regarding situation semantics as a language that requires interpretation in the manner shown above by asking what we have lost by doing so. Alternatively, this question can be turned around to ask what Barwise and Perry gain by using set theory to construct abstract entities that "classify" real situations. In fact, they gain nothing, because the two formulations are formally equivalent. Barwise and Perry's version does not explicitly contradict the philosophical and metatheoretical backdrop

attached to the formalism (their set theoretical formulation merely hides the language-dependence of their theory -- and everyone else's); otherwise there is no advantage gained. Because the difference lies at the level of the philosophical claims made about the formalism, Barwise and Perry have not provided a formal theory more suited for ecological semantics with its claim that meaning is in the world than the theory specified above.

Barwise and Perry make two claims that are thrown into question: that meaning is in the world and that abstract situations classify real situations. We saw that there are problems for the view that meaning is in the world: the Object NP Problem (which is only part of a more general problem) shows us that regarding the references of sentences as having some structure and being built out of pieces contributed by the constituent expressions means that the position of these pieces within the structure is correlated with, indeed (partly) determined by the syntactic structure of the object language sentence. The structures that are the references of (7) and (8) should be very similar -- identical in fact, except that the pieces corresponding to 'Jackie' and 'Molly' are interchanged when we pass from one sentence to the other.

(7) Jackie is biting Molly.

(8) Molly is biting Jackie.

Either the meaning or the interpretation of 'Jackie' changes when we pass from (7) to (8). Now the interpretation, if it is Jackie herself, does not change; nor, therefore, can the meaning change.¹⁵ Alternatively, if both meaning and interpretation remain constant, the construction of the structured entity that is the reference of a sentence needs help from the syntax as to which structure to build.

It is generally recognised that such guidance from syntax is required (Partee, 1983); but that is to admit that meaning is not independent of the object language syntax. In defining $\underline{L}(b, R, \mathcal{L})$, we have made explicit the fact that the interpretations of expressions are pieces that must be put together in particular ways to generate the interpretations of containing expressions -- in other

words, that interpretations have a syntax.

Once this is established, it becomes clearer what the relation of abstract situations to real situations is: the relation is one of representation; abstract situations represent the way the world is or might be, or could have been but is not; some abstract situations represent impossible, because incoherent, states of the world. By thinking of the level of abstract entities as linguistic, we are again making explicit the fact that they represent things in the world, not "classify" them.

5.3 Molecular situations

5.3.1 Cooper's introduction of molecular facts

To continue the investigation of this question of whether some of the semantic entities of situation semantics are quasi-linguistic, I shall consider a version of the theory developed by Robin Cooper and presented in his (1984) Cooper remarks that in Situations and Attitudes Barwise and Perry have proposed an account of VP negation only, and in this paper he extends the theory by adding a treatment of sentential negation. What interests us are the changes and additions to the theory that he makes in doing so.

A remark on terminology is needed at this point. In this discussion of Cooper's work, I shall follow his use of the word 'fact' to refer to the set theoretic entities used to represent real facts (what Barwise calls 'circumstances'). Barwise has been very much concerned with the relation between the set theory and the world, and attempts to distinguish them (but he is not careful enough!); it is rather puzzling, therefore, to find that Cooper quite simply uses the word 'fact', which for Russell and Barwise is the thing in the world, to refer to the set theoretic entity.

Cooper begins by setting out a problem that has to be dealt with by any semantic theory of sentential negation. In the case of

VP negation, a sentence such as 'John did not see Mary' describes a situation \underline{s} just in case a certain negative fact is in \underline{s} , so that if one tried to add the corresponding positive fact to \underline{s} , an inconsistent (ie. incoherent) situation would result. The problem Cooper has found concerns how to construct the semantics so that this property is preserved in the case of negation at the sentence level. To see what the problem is that Cooper raises for accounts of sentence negation, consider the following proposal for handling sentential negation in a situation semantics framework:

(9) $-\underline{S}$ describes a situation \underline{s} iff \underline{S} does not describe \underline{s} .

If the proposal (9) is adopted, no particular fact is required to be present in \underline{s} for $-\underline{S}$ to describe it, so that in general no inconsistency will arise by adding to \underline{s} the positive fact occurring in every situation described by \underline{S} .

What negative fact or facts, then, should be in \underline{s} for $-\underline{S}$ to describe it? As Cooper points out, if \underline{S} is atomic, the required fact is the negative fact corresponding to the positive fact occurring in every situation described by \underline{S} (where by corresponding I simply mean inverting the truth value). But if \underline{S} is molecular, there is a problem: there is no single set of negative facts that $-\underline{S}$ should describe definable for every case simply in terms of \underline{S} alone -- one has to look and see whether \underline{S} is a conjunction, disjunction, etc. before one can say which are the relevant facts. But doing this gives up the property of compositionality. This is the problem that motivates Cooper's introduction of molecular facts.

Cooper proposes that we should also admit as facts a number of molecular facts of various kinds, of which some examples follow. Let \underline{f} and \underline{g} be facts; then we also have:

(10) a. $\langle \text{and}, \underline{f}, \underline{g}, 1 \rangle$

b. $\langle \text{or}, \underline{f}, \underline{g}, 0 \rangle$

The symbols 'and' and 'or' here represent relations between facts. That such a relation holds or does not hold is itself a real fact,

and thus something to be represented in the theoretical apparatus, in the form illustrated in (10). Since it would be inadequate to have an actual situation which contained a fact $\langle \text{and}, \underline{f}, \underline{g}, 1 \rangle$, but did not contain \underline{f} itself, there must be conditions that situations are required to satisfy in order to be actual. Structural constraints are therefore used to ensure that in any actual situation containing a molecular fact other facts hold about the constituents of that molecular fact, and so on recursively, until one or more atomic facts are constrained to be in the actual situation.

Cooper has essentially relocated the rules governing which negative facts need to be in the situations described by utterances of $-\underline{S}$; instead of looking at the internal structure of \underline{S} to decide which set of negative facts is appropriate, the rules are formulated as structural constraints on actual situations involving molecular facts. To show the reader what these structural constraints are like, we display one example of a constraint:

- (11) For any actual situation \underline{s} , if $\langle \text{and}, \underline{f}_1, \underline{f}_2, 1 \rangle \in \underline{s}$,
then $\underline{f}_1 \in \underline{s}$ and $\underline{f}_2 \in \underline{s}$.

In his appendix, where a more formal account for a particular formal language is given, Cooper also has molecular facts of the kind $\langle \text{not}, \underline{f}, 1 \rangle$ and $\langle \text{not}, \underline{f}, 0 \rangle$.¹⁶

5.3.1.1 Reflection on the status of the semantic entities

Having laid out these details of the system, Cooper reflects on what he has done:

Have we not encoded part of the syntax of propositional logic in the semantic objects of our model theory by introducing conjoined facts? Have we not furthermore introduced something like part of a proof theory for propositional logic into our calculus of semantic objects by using structural constraints like those in [3]?
(Cooper, 1984, p. 4)

The additional structure in the model theory of situation

semantics is what makes it possible to represent partial information and to solve certain problems with propositional attitudes. [...] Yet this very structure which seems to be providing us with such intriguing semantic advantages is giving the model theoretic objects themselves a kind of syntax, a syntax which might bear important similarities to the syntax of the natural language being interpreted, as seems to be the case with this suggested analysis of conjunction. (Cooper, 1984, pp. 4,5)

Cooper here tackles a very important point, one of central concern to us. We have been arguing that in building structure into the model theory, Barwise and Perry have made their semantic entities quasi-linguistic. If situation semantics is extended along the lines that Cooper takes, by adding in molecular facts, then the need for structural constraints on actual situations certainly means that yet another kind of syntax is being laid over the semantics. Cooper's development of the theory focuses our attention on conjunction, disjunction and negation, and on the fact that the syntax involved encodes a propositional logic. However, there is more syntax than this embedded in Cooper's semantics, a syntax which is closely related to that of natural language, and which is found at the subsentential level.

Consider the formal system described in the appendix to Cooper's paper. One of the syntactic rules is $VP \rightarrow V_t N$ (the grammar is a fairly simple one -- its purpose is to be illustrative), and the corresponding semantic rule is:

$$\llbracket [V_t N]_{VP} \rrbracket = U_o(\llbracket [V_t] \rrbracket , \llbracket [N] \rrbracket)$$

A function \underline{m} assigns interpretations to lexical items. An expression α of type V_t is assigned by the interpretation function the value $\llbracket [\alpha]_{V_t} \rrbracket = \langle \underline{m}(\alpha), s, o, 1 \rangle$ and an expression β of type N is given the value $\llbracket [\beta]_N \rrbracket = \underline{m}(\beta)$. Finally, the notation $U_o(\llbracket [V_t] \rrbracket , \llbracket [N] \rrbracket)$ signifies that $\llbracket [N] \rrbracket$ is to be substituted for o in $\llbracket [V_t] \rrbracket$ at each occurrence. Notice how the semantic rule operates. The interpretation of a transitive verb α in this system is a quadruple $\langle \underline{r}, s, o, 1 \rangle$ where $\underline{r} = \underline{m}(\alpha)$ is the relation designated by α , 1 is the familiar truth value, and s and o are basically place holders

(called distinguished indeterminates). (So Cooper shows us this structure, which Barwise and Perry have not done, as we remarked in chapter three.) If β is a noun phrase with $\llbracket \beta \rrbracket = \underline{m}(\beta) = j$, say, then $\llbracket [\alpha\beta]_{vp} \rrbracket = \langle \underline{x}, s, j, 1 \rangle$. Cooper uses s and o and his unification operation U to perform essentially the same function that Barwise and Perry (1983) assign to distinguished indeterminates and settings. Therefore, the same kinds of question arise in this context: what are the semantic roles, and what is the exact status, of the indeterminates s and o ?

What Cooper has in fact done is to enlarge the context in which to ask this question; he has shown us that this basic question about the linguistic or other status of the semantics arises at the molecular level as well as at the subsentential level. The semantic value of a conjunction is $\llbracket [\alpha]_{conj} \rrbracket = \langle \underline{m}(\alpha), f, g, 1 \rangle$, which employs the distinguished indeterminates f and g -- but he could equally well have used s and o in this rule and modified the recursive definition

$$\llbracket [S_1 \text{ Conj } S_2]_S \rrbracket = U_f(U_g(\llbracket [Conj] \rrbracket, \llbracket [S_2] \rrbracket), \llbracket [S_1] \rrbracket)$$

slightly to accommodate this. In fact he could have used any objects as place holders, for that is all the indeterminates are. But we must not be misled by his use of s and o in the one case (suggesting subject NP and object NP), and f and g in the other case (suggesting the first and second facts of the conjunction respectively). Is there more than the mere appearance of embedding the syntax of the object language expressions in Cooper's semantics?

The real question remains after any confusion surrounding the notation has been cleared out of the way: the question of whether or not the semantic level partially embeds the syntax of the language. The answer, it seems, is that to a large extent it does. It is not the actual objects used in the case of the indeterminates, for they are merely place holders, but the role that is assigned to them, that is crucial. The embedding occurs on two accounts. First there is an embedding at the level of the internal structure of situations; we have already commented on this above, pointing out that Cooper's

approach is essentially the same as Barwise and Perry's, and consequently the way in which the interpretations of the parts are put together requires to be controlled by something external to the interpretations themselves -- ie. a syntax must be imposed upon them.

The second way in which Cooper's semantics embeds the syntax of the object language is by admitting molecular facts. Allowing facts like $\langle \text{and}, \underline{f}, \underline{g}, 1 \rangle$ into the theory creates a semantic object corresponding to the sentence $\underline{F} \ \& \ \underline{G}$ where $[\underline{F}] = \underline{f}$ and $[\underline{G}] = \underline{g}$. The object thus admitted is a set theoretic entity constructed from 'and', two constituent facts, and a truth value, and we have been arguing for the essentially linguistic underpinings of this use of the set theory. In particular, we should notice that there are now two distinct molecular facts -- namely $\langle \text{and}, \underline{f}, \underline{g}, 1 \rangle$ and $\langle \text{and}, \underline{g}, \underline{f}, 1 \rangle$ -- corresponding to the sentences $\underline{F} \ \& \ \underline{G}$ and $\underline{G} \ \& \ \underline{F}$. In standard theory the level of syntax is finer than the semantics: there are, to stay with conjunction, two sentences but only one corresponding semantic object, the proposition to the effect that both \underline{F} and \underline{G} . Whether we are looking at extensions (truth values) or intensions (functions from possible worlds to truth values), there is no difference semantically between the semantic correlates of $\underline{F} \ \& \ \underline{G}$ and $\underline{G} \ \& \ \underline{F}$. But now in Cooper's theory we have two semantic objects, with a direct parallelism between these two semantic objects and the two sentences.

The admission and use of molecular facts in situation semantics is, as far as I know, peculiar to Cooper (but see chapter six on Almog's recent work); yet if Barwise and Perry, or anyone else, do not want to take the same course, they have either to find an alternative solution to the problem of sentential negation, one which does not require molecular facts, or to refute Cooper's arguments that sentential negation needs to be handled in the semantics.

Finally, it is interesting to note that Cooper does not consider that the apparatus he uses should be considered as a language -- rather, he explicitly rules it out:

[...] I would point out that the model theoretic objects

of situation semantics are just that. They are not expressions of a language which then undergoes interpretation. (Cooper, 1984, p. 5)

However, he does admit that the semantic entities of situation semantics may be able to perform the role normally undertaken by the level of logical form. The passage above continues:

It may just be that situation semantics is providing us with a truly semantic theory which uses exactly the right kind of model-theoretic structures which we need to analyze natural language. It may allow us to do in the semantics the kinds of things that we thought we needed a level of semantic representation or logical form for. (Cooper, 1984, p. 5)

Cooper interprets this state of affairs as meaning that semantics can take over the tasks performed by the level of logical form and still remain semantics; he does not consider that situation semantics may thereby lose its semantic status.

Wittgenstein used the phrase 'logical form' to refer to the irreducible minimum which a picture of any kind shares with what it pictures.¹⁷ The notion of logical form for Wittgenstein is an integral part of the picture theory of meaning of the Tractatus Logico-Philosophicus, which presents a theory about the relation between language and the world, or more generally, between a symbol system and that which it is used to represent.

The notion of logical form has since come to mean additionally a level of representation which displays the logical form of a proposition¹⁸ or assertion more explicitly than natural language, and for this purpose logical calculi are usually employed (echoes of Frege). If Cooper is right and interpretations in situation semantics may be used as representations of the logical form of propositions, abstract situations are being given a representational role par excellence, and their relation to real situations is one of linguistic representation, not classification.

5.3.2 Quantification and molecular situation

Cooper believes that situation semantics should attempt to handle sentence negation, and his treatment introduces new kinds, or forms, of facts into the semantics. Is it possible to argue that treating quantification requires the addition of yet more new kinds of facts or situations? Like Russell before him, Cooper finds that negative, conjunctive and disjunctive facts are all bound up together; but unlike Russell, Cooper is working with structured entities in the semantics and argues for introducing conjunctive and disjunctive (and negative) facts. Negation is also bound up together with the existential and universal quantifiers, so could, and should, we introduce more new kinds of facts -- "quantified facts"? In this section I present an argument, similar to Cooper's for conjunctive, disjunctive and negative facts, that we need to do so, and then explore how it might be done.

5.3.2.1 The addition of general NPs and general propositions

Singular propositions and singular terms can be dealt with conveniently in Barwise and Perry's semantics; but they say very little about general NPs such as 'someone' in the book.¹⁹ Traditionally, a sentence such as

(12) Someone has been smoking.

has been assigned the logical form $\exists x F(x)$ (neglecting aspect), which involves an existential quantifier. The conviction that the semantics of natural language should start with natural language, not mathematics or formal logic, leads Barwise and Perry to base their theory on the linguistic analysis of (12), that is, the structure NP VP, rather than the traditional logical form. The VP has its usual interpretation; but the NP, being a general NP, is a relation between a discourse situation \underline{d} , speaker connections \underline{c} , sets of individuals \underline{x}_c , and situations \underline{e} , rather than a relation between \underline{d} , \underline{c} , individuals a_c , and situations \underline{e} , as with singular NPs.²⁰

Although Barwise and Perry fail to define the semantics for general NPs in their book, it is possible to reconstruct the semantics they perhaps would have wanted to give (at that time), and this I shall now do for the quantifier 'some'.²¹ I shall work within the framework of Singular Aliass to add precision to the definition. We add the lexical item 'some' to the grammar, with $\text{SCat}(\text{some}) = \{ \mathbf{X}, \mathbf{Y} \}$. Its meaning is given by:

$$(13) \quad \underline{d}, \underline{c} \llbracket \text{some} \rrbracket \sigma, \underline{e} \text{ iff } \underline{Y}_{\sigma} \subseteq \underline{X}_{\sigma} \text{ and } \underline{Y}_{\sigma} \neq \emptyset.$$

We need to add to the grammar the NP rule (14) below, which clearly parallels rule NP3 of Singular Aliass.

(14) NP rule: if \sum is the quantifier 'some', π is a PrPh and e_i is one of the event indeterminates, then $(\sum \pi)$ is an NP with $\text{SCat} = \{ \mathbf{Y}, e_i \}$. We indicate this feature by writing $(\sum \pi)^i$. Its features Var, Tense, AF and RS are the same as those of π . Its meaning is:

$$\underline{d}, \underline{c} \llbracket (\sum \pi)^i \rrbracket \sigma, \underline{e} \text{ iff there is an extension } \sigma' \text{ of } \sigma \text{ so that } \underline{X}_{\sigma'} = \underline{d}, \underline{c}_{\sigma'} \text{Ext}(\pi, e_{i, \sigma}) \text{ and } \underline{d}, \underline{c} \llbracket \sum \rrbracket \sigma', \underline{e}.$$

Here Ext is just Barwise and Perry's function Ext, the set of all individuals which in \underline{e} have the property denoted by π ; the definition is reproduced here for convenience:

$$(15) \quad \underline{d}, \underline{c}_{\sigma} \text{Ext}(\pi, \underline{e}) = \{ a \mid \underline{d}, \underline{c} \llbracket \pi \rrbracket \sigma', \underline{e}, \text{ where } \sigma' \text{ agrees with } \sigma \text{ except possibly on } a \}.$$

Such, we may suppose, is the semantics Barwise and Perry would have given.

In defining this semantics for general NPs, I have really only modified Barwise and Perry's semantics for singular terms to handle sets of individuals in place of individuals. Essentially, the general NP 'some \underline{F} ' picks out of a situation all the individuals that are \underline{F} in that situation, and then picks out some of these, ie. its

interpretation is a nonempty subset of all the individuals that are \underline{F} in the situation described.

The semantics is not complete for we have yet to define how a general NP and a VP or PrPh combine to form an S. The interpretation of a singular NP is an individual which is suited to fit into the "situation-with-a-hole", which is essentially the interpretation of the PrPh; but general NPs provide us with a set of individuals. There are two possible ways of proceeding that immediately occur to one. First, we could just slot the set of individuals into the interpretation of the PrPh; such a solution, however, is unsatisfactory, for it would mean that an utterance of (12) has as interpretation situations in which a nonempty set of individuals possesses the property of having been smoking. Clearly, this is not what we want. The other course is to understand a sentence containing a general NP as describing a situation in which each individual in the set contributed by the general NP possesses the property contributed by the rest of the sentence. The interpretation of an utterance of (12) would then be a situation \underline{e} such that

in \underline{e} : at \underline{l} : smoking, \underline{y}_1 ; yes

smoking, \underline{y}_2 ; yes

.

.

smoking, \underline{y}_n ; yes

where $\underline{l} = \underline{c}$ (has been) and $\underline{Y}_c = \{\underline{y}_1, \underline{y}_2, \dots, \underline{y}_n\}$.

This completes the outline of the first attempt to provide a semantics for general NPs. We shall now evaluate the adequacy of this semantics.

5.3.2.2 Inadequacy of the semantics

There is with this semantics no particular fact in \underline{e} that corresponds to the proposition expressed by (12), as ordinarily conceived. Cooper is convinced that sentence connectives such as

'and' and 'or' require us to introduce molecular facts (eg. $\langle \text{and}, \underline{f}, \underline{g}, 1 \rangle$): just having the facts \underline{f} and \underline{g} in a situation is sometimes not enough. In arguing against (9) as the semantics for sentential negation, Cooper shows us that (16) is inadequate as the semantics for 'and':

- (16) $\underline{S} \ \& \ \underline{T}$ describes a situation \underline{s} iff \underline{S} describes \underline{s} and \underline{T} describes \underline{s} .

This is indeed the correct semantics if we do not admit molecular facts, but when we do, (16) is not strong enough to ensure that a particular conjunctive fact is in the interpretation of $\underline{S} \ \& \ \underline{T}$. Can we argue similarly that (14) is inadequate as the semantics for 'some' (and thus also against similar proposals for other quantifiers)?

Cooper's argument is based on sentence negation and conjoined sentences; similarly, we can argue from cases involving sentence negation and quantifiers for the need to have some suitable single, definite fact in any situation described by an utterance of a sentence containing a quantifier. To show this, let us suppose that (14) is the appropriate semantics for 'some', and let us say that the semantics of 'no' would be parallel to (14) except that the set \underline{Y} would always be required to be empty. The meaning of 'no' would therefore be given by

$$\underline{d}, \underline{c} \models [\text{no}] \ \sigma, \underline{e} \text{ iff } \underline{Y}_{\sigma} \subseteq \underline{X}_{\sigma} \ \& \ \underline{Y}_{\sigma} = \emptyset$$

with $\text{SCat}(\text{no}) = \{ \underline{X}, \underline{Y} \}$.²² What is necessary, we then ask, for a situation to be in the interpretation of an utterance of (17)?

- (17) No one has been smoking.

Is it enough for situations in the interpretation of utterances of (17) simply not to assert or predicate of each of the individuals mentioned in them that they are not smoking? This is the only restriction we can place on a situation in the interpretation of an utterance of (17) at the moment, with a semantics based on (14); we can include no single definite fact in such situations corresponding

to the proposition expressed. Although adding in facts that specify that an individual has been smoking produces a situation that is no longer in the interpretation of the utterance, it does not produce an incoherent situation. The semantics fails this criterion.²³

Moreover, the semantics is inadequate in another respect. It turns out that the semantics formulated in (14) means that the interpretation of an utterance of (17) is the class of all situations which, for all individuals $a \in A$, do not specify that a has been smoking. The interpretation of an utterance of

(18) No suitor was able to string the great bow of Odysseus.

is the class of situations in which no individual was able to string the great bow of Odysseus; this is not quite what we want -- we want the class of situations in which no individual who is a suitor (of Penelope) in that situation was able to string the great bow of Odysseus. In requiring $\underline{Y}_\sigma = \emptyset$ as the only effective condition for the quantifier 'no', we have lost all reference to suitorship. Hence the interpretation of utterances of (18) is identical to that of an utterance of

(19) No servant was able to string the great bow of Odysseus.

We need to retain reference to the set X right up until the general NP is combined with the PrPh to form a sentence, rather than dropping that set once the general NP has been formed. The proper semantics for forming a general NP from a quantifier \sum and PrPh π is:

(20) NP rule: if \sum is the quantifier 'some', π is a PrPh and e_i is one of the event indeterminates, then $(\sum\pi)$ is an NP with $\text{SCat} = \{X, Y, e_i\}$. We indicate this feature by writing $(\sum\pi)^i$. Its features Var, Tense, AF and RS are the same as those of π . Its meaning is:

$$\underline{d}, \underline{c} \models [(\sum\pi)^i] \models \sigma, \underline{e} \text{ iff } \underline{X}_\sigma = \underline{d}, \underline{c}, \sigma \text{Ext}(\pi, \underline{e}_i, \sigma) \text{ and } \underline{d}, \underline{c} \models [\sum] \models \sigma, \underline{e}.$$

The result is that now situations in which a servant, but no suitor, is able to string the great bow of Odysseus will be in the interpretation of an utterance of (18), and situations in which a suitor, but no servant, is able to string the great bow of Odysseus will be in the interpretation of an utterance of (19).

However, we still have no single definite fact in these interpretations, and this causes problems when we consider negation, as Cooper did. Cooper pointed out that the inadequacy of an account of sentential negation that utilises

(21) $\neg \underline{S}$ describes a situation \underline{s} iff \underline{S} does not describe \underline{s}

is that there are no negative facts in situations in the interpretation of utterances of \underline{S} that would make them inconsistent with other facts. Providing a semantics for sentential negation means adding conjunctive and disjunctive facts, because the subsentence \underline{S} negated might itself be a conjunction or a disjunction. If we consider the case where \underline{S} is a quantified sentence, we can argue for the need for "quantified facts" as follows.

Consider the sentence

(22) Not everyone in the palace failed to string the great bow of Odysseus.

The initial 'not' tends to be read as negating the general NP rather than the whole subsentence. However, we shall understand this as a case of sentential negation, reading 'not' as 'it is not the case that', and considering the sentence therefore as having the logical form $\neg \forall x Fx$ (quantification implicitly being restricted to the domain of those in the palace).

The semantics for general NPs we have provided means that the interpretation of an utterance of the subsentence

(23) Everyone in the palace failed to string the great bow of Odysseus.

contains situations \underline{s} such that for all individuals $y \in \underline{Y}_{\underline{s}} = \underline{X}_{\underline{s}}$ = the set of all people in the palace,

in \underline{e} : at \underline{l} : \underline{F} , \underline{y} ; yes

where $\underline{l} = \underline{c}(\text{failed})$ and \underline{F} abbreviates 'failed to string the great bow of Odysseus'. What then should be the condition on situations in the interpretation of an utterance of (22)? Applying Cooper's argument, we need a nonempty subset \underline{Y}_σ of \underline{X}_σ such that

in \underline{e} : at \underline{l} : \underline{F} , \underline{y} ; no

for all $\underline{y} \in \underline{Y}_\sigma$; that is, situations in the interpretation of an utterance of (22) must specify that some individuals (ie. at least one) did not fail to string the great bow of Odysseus. If we merely require the weaker condition that there is a nonempty subset \underline{Y}_σ of \underline{X}_σ such that \underline{e} does not specify that \underline{y} failed to string the great bow of Odysseus for each $\underline{y} \in \underline{Y}_\sigma$, then (22) is consistent with (23).

We have established that we must have facts $\langle \underline{l}, \underline{F}, \underline{y}, 0 \rangle$ in the interpretation of utterances of (22); the general problem Cooper has drawn our attention to is that there is no way to impose this condition through the rule for sentential negation -- when 'not' is combined with a sentence \underline{S} , -- unless we admit molecular facts into the semantics. Cooper himself introduced conjunctive and disjunctive facts; similar considerations, as we have just seen, demonstrate that we need a definite positive fact in situations described by sentences containing 'some' and a definite negative fact in situations described by sentences containing 'no', and structural constraints in addition. The conditions that $\underline{Y}_\sigma \neq \emptyset$, imposed on the meaning of 'some', and that $\underline{Y}_\sigma = \emptyset$, imposed on the meaning of 'no', are simply too weak: we need some specific fact in the described situation.

5.3.2.3 The addition of "quantified facts"

How might we add "quantified facts" to the semantics and what form should they take? Unlike the case of 'and', 'or' and 'it is not the case that', which Cooper introduced into the semantics encoding a propositional logic, the quantifiers require us to be able to quantify into the constituent facts of the new compound fact. The

logical form of (12) has traditionally been regarded as $\exists x F(x)$ -- consisting of an open sentence $F(x)$, whose free variable is bound by a quantifier. Encouraged by the parallels we found between situation semantics and formal languages, we could try to represent the open sentence by a situation type $E(a)$. This situation type is intended to correspond to the VP 'is smoking'. Assuming that only people smoke (in the intended sense of 'smoke'), so that (12) means that some person has been smoking, E would be

$E :=$ at $\underline{1}$: person, a ; yes
smoking, a ; yes

with $\underline{1} \leq \underline{1}_d$. Pursuing this approach further, the existential quantifier $\exists x$ would be represented by an operator that binds the free variable (the indeterminate) thus: 'some(a)'. Our quantified facts would look like

- (24) a. $\langle \text{some}(a), E(a), 1 \rangle$
b. $\langle \text{no}(a), E(a), 1 \rangle$

We have perhaps adhered too closely to the logical form as represented in the predicate calculus: we arrived at (24a) as the fact corresponding to the sentence (12) by concentrating on the logical form $\exists x F(x)$, in which the quantification ranges over all the individuals in the universe. The English sentence

- (25) Some dog is barking.

on the other hand is more naturally viewed as involving a case of restricted quantification, but can only be represented on this approach as $(\exists x)(D(x) \ \& \ B(x))$, using $D(x)$ for 'x is a dog' and $B(x)$ for 'x is barking'. While this is basically the course followed by Cooper in his semantics for the indefinite article in Montague Grammar,²⁴ it distorts the natural language syntax considerably. The "dog-ness" of (25) gets moved from the NP 'some dog' at the level of the syntax to the subsentence $D(x) \ \& \ B(x)$ in the logical form representation $\exists x(D(x) \ \& \ B(x))$.

To avoid this, Barwise and Cooper (1981) assign to a quantifier a family of sets, to a VP a set, and a sentence consisting of a quantifier and a VP is true if the set is in the family. If \underline{A} is the universe of individuals, and \underline{D} the set of dogs, then the NP 'some dog' denotes the family $\{ \underline{X} \subseteq \underline{A} \mid \underline{X} \cap \underline{D} \neq \emptyset \}$. Each set \underline{X} in this family will contain at least one dog, but there are other individuals in \underline{X} too, a state of affairs dictated by the way truth is defined.

We seek a representation of "quantified facts" which does not appear to involve quantification over the whole domain as (24) does. A more attractive alternative than (24), one which takes note of Barwise and Cooper (1981), would be to have facts of the form $\langle \text{some}, \underline{D}, \underline{B}, 1 \rangle$ for the proposition expressed by an utterance of (25), where \underline{D} and \underline{B} are event types given by:

$\underline{D} := \text{at } \underline{l}: \text{dog}, a; \text{yes}$

$\underline{B} := \text{at } \underline{l}: \text{barking}, a; \text{yes}$

To make the indeterminate explicit, we should write

(26) $\langle \text{some}, \underline{D}(a), \underline{B}(a), 1 \rangle$.

As used in this representation of molecular facts, 'some' is a relation between situation types (cf. Cooper's relations 'and' and 'or' between facts). An utterance of (25) describes a situation in which there is a fact of the form (26): such a described situation is one where there is something (represented by the indeterminate) which is a dog and which is also constrained to be barking.

Like Cooper, we need structural constraints to ensure that additional facts hold in actual situations. Recall that actual situations are abstract situations which correspond exactly to real situations. Clearly it would not do for an actual situation to contain the fact $\langle \text{some}, \underline{D}(a), \underline{B}(a), 1 \rangle$, yet not to contain any fact $\langle \underline{l}, \text{barking}, \underline{a}, 1 \rangle$ for some individual $\underline{a} \in \underline{A}$ (or indeed not to contain such a fact for some dog $\underline{a} \in \underline{A}$). More formally, suppose (25) is uttered truly; then there is some real situation \underline{e}_{re} in which a dog is barking, and further, if the present proposal for the

semantics of general NPs is adopted, each situation in the interpretation of this utterance of (25) will contain the fact (26). Since the utterance is true, one of these abstract situations must be actual, ie. it must classify e_{re} precisely. Suppose that e is this actual situation in the interpretation of (25); suppose further that e does not contain any fact of the form $\langle \underline{l}, \text{barking}, \underline{a}, 1 \rangle$. Then, contrary to hypothesis, e is not actual, for there is an e' that classifies e_{re} but which is not part of e , namely $e' = e \cup \{ \langle \underline{l}, \text{barking}, \underline{a}, 1 \rangle \}$, where \underline{a} is a dog which is barking in e_{re} . (For e is actual if it corresponds to a real situation, and e corresponds to e if e classifies e and every e' that classifies e is part of e ; see Barwise and Perry, 1983, p. 61.) Hence actual situations which contain facts of the form (26) must also contain certain particular facts such as $\langle \underline{l}, \text{barking}, \underline{a}, 1 \rangle$.

The structural constraints that we need for 'some' and 'all' are:

(27) For any actual situation \underline{s} , if $\langle \text{some}, Q(\underline{x}), E(\underline{x}), 1 \rangle \in \underline{s}$, then there is a set $\underline{Y} \subseteq \underline{X}$, $\underline{Y} \neq \emptyset$, where $\underline{X} = \{ \underline{x} \mid Q[\underline{x}] \subseteq \underline{s} \}$, and $E[\underline{y}] \subseteq \underline{s}$ for all $\underline{y} \in \underline{Y}$.

(28) For any actual situation \underline{s} , if $\langle \text{some}, Q(\underline{x}), E(\underline{x}), 0 \rangle \in \underline{s}$, then for any $\underline{Y} \subseteq \underline{X}$, $\underline{Y} \neq \emptyset$, where $\underline{X} = \{ \underline{x} \mid Q[\underline{x}] \subseteq \underline{s} \}$, $E[\underline{y}] \not\subseteq \underline{s}$ for all $\underline{y} \in \underline{Y}$.

(29) For any actual situation \underline{s} , if $\langle \text{all}, Q(\underline{x}), E(\underline{x}), 1 \rangle \in \underline{s}$, then for all $\underline{y} \in \underline{X} = \{ \underline{x} \mid Q[\underline{x}] \subseteq \underline{s} \}$, $E[\underline{y}] \subseteq \underline{s}$.

(30) For any actual situation \underline{s} , if $\langle \text{all}, Q(\underline{x}), E(\underline{x}), 0 \rangle \in \underline{s}$, then there is a nonempty set $\underline{Y} \subseteq \underline{X} = \{ \underline{x} \mid Q[\underline{x}] \subseteq \underline{s} \}$ such that $E[\underline{y}] \not\subseteq \underline{s}$ for each $\underline{y} \in \underline{Y}$.

This completes the account of how "quantified facts" might be added to situation semantics.

5.4 Conclusion

In this chapter we have argued that situation semantics fails in practice to vindicate the claim that it views meaning as in the world independent of language. In the first section (5.1) we argued for this from a consideration of the function of the setting and indeterminates in the semantics and from the use to which the level of abstract entities is actually put: abstract situations become the object of study and hence they are not used to classify real situations, but enter as a level of representation between thought and real situations.

In the second section (5.2) we showed how the level of abstract entities in situation semantics could be regarded as a formal language which must be interpreted, and we gave a standard model theoretic semantics for it. Thinking of situation semantics in this fashion shows that Barwise and Perry have gained nothing by using set theory and talking of meaning in the world; on the contrary it has the advantage of making explicit the linguistic and representational status of the abstract entities.

Finally, in the third section (5.3) we considered Robin Cooper's extension of the theory, and introduced further kinds of abstract situations ourselves. The particular aim of this section was to show how more syntax or linguistic structure could be, or perhaps needs to be, embedded at the semantic level.

The overall thrust of the chapter is to argue that situation semantics has not shown us how to do semantics with meaning located in the world independent of language, as promised, but is still committed to a concept of meaning, or of some level thereof, which is essentially linguistic or syntactical, and which therefore represents reality.

Chapter Six: Kaplan, Almog and Direct Reference Theory

6.0 Introduction

We have been concerned with the nature and status of the various semantic entities in situation semantics; in particular, we have asked what sorts of thing propositions and abstract situations might be. The question about propositions exercised Russell considerably, and he thought hard enough about it as to change his opinions on the matter: in chapter four we charted the progress of his thought (section 4.1). Although Moore and Russell both argued, early in their careers, that propositions were parts of the world, this view was later abandoned because of the problem of explaining which part of the world (which proposition) was expressed by a false utterance: the problem was that propositions could be non-actual. From that time, propositions were considered not to be located in the world, but, as the Fregean theory became the ruling orthodoxy, were identified with Fregean senses; they were denizens of Frege's third realm -- public and capable of being grasped (they were intuitable), but neither physical nor mental. Then, from about 1970, David Kaplan began to produce work that challenged this view. His championship of direct reference semantics saw a return to having real world entities as constituents of propositions.

One feature of situation semantics -- that basic and sometimes compound expressions refer to individuals and properties themselves, and that abstract situations are composed of these referents -- makes it almost impossible to refrain from comparing situation semantics with direct reference theory. Kaplan was influenced in his early years, like everyone else at that time, by the ascendancy of Fregean semantics. It was 'the Golden Age of Pure Semantics ... with language, meanings, and entities of the world each properly segregated.'¹ This influence peaks with Kaplan (1969); thereafter Kaplan, through his work on demonstratives and indexicals, elaborated the direct reference view with its employment of singular

propositions, which contain ("bare") individuals. From this perspective abstract situations are singular propositions generalised to contain properties, rather than extensions or intensions. It is this parallelism that motivates the comparison of direct reference theory with situation semantics.

To pursue a detailed investigation of the relation of situation semantics to direct reference theory, I shall consider David Kaplan's work reported in 'How to Russell a Frege-Church' (Kaplan, 1975), which is a model example of the exercise of comparing and relating two theories. Kaplan was concerned in that paper to argue for the hypothesis that Frege-Church semantics plus haecceitism equals Russellian semantics; his technique is to relate the ontologies of the Russellian and Fregean theories. Since this work is important for any investigation of the nature of situation semantics and its relation to other theories, I shall first discuss his argument and results. This will enable us to lay out the Russellian and Frege-Church ontologies, to which we shall relate the ontology underlying Richards' theory.

In section (6.2), I shall apply the same strategy to situation semantics, setting out its ontology and thereby relating it to the other theories. A full comparison will require the addition of a semantics for necessity and possibility to situation semantics, which I provide. Many features of the situation semantics approach should then become clear: for example, the roles of the various kinds of entity, where the intensionality is located in the theory, and in general the basic structure of the semantics. I shall also compare situation semantics to the other theories in terms of some other notions and issues that are central to Kaplan (1975); I have in mind here the questions of actualism and possibilism, essentialism and haecceitism, and the role of singular propositions.

Direct reference theory has recently been analysed and extended by Joseph Almog, whose work I shall consider here. Direct reference semantics is a relation of situation semantics since both derive a great deal of inspiration from the work of Russell. Direct reference theory countenances the existence of singular propositions; however,

even singular propositions contain at least one constituent (the sense of the predicate) that is not part of the world, but still dependent on language. For all its breaking with Fregean semantics in other respects, Kaplan's theory remains one that ties the senses and references of some kinds of expression to language (hence sense and reference are not language-independent). Interestingly, in Almog's recent work properties of certain kinds are constituents of singular propositions. Thus the two theories, situation semantics and recent direct reference semantics, appear to have a good deal in common, and a comparison will illuminate the issues that concern us.

6.1 Kaplan's (1975) Analysis

Essentially, Kaplan's strategy is to set out the entities that each approach employs -- the ontology of each theory, -- to remark that Russell's is seen to be a small part of the Frege-Church ontology, and then to show how to reduce the Frege-Church ontology to that proper part of itself that corresponds to Russell's ontology. When this has been done, Kaplan claims, a comparison of the Russellian and reduced Frege-Church ontologies shows immediately that the difference between them is haecceitism.

Kaplan's analysis in 'How to Russell a Frege-Church' is couched in terms of the possible worlds framework, which allows him to represent propositions as sets of possible worlds and to define the notions of necessity and possibility, which are crucial to the discussion of haecceitism.² Since Barwise and Perry have not said anything about how these would be treated modalities in their work, I provide below an analysis of necessity and possibility in the situation semantics framework, an analysis which I believe remains faithful to the spirit of the situational approach to semantics.

For his analysis Kaplan takes as representative of Russellian semantics Russell's early views, from 'On Denoting' and Principia Mathematica (the first edition). Additionally, the view he calls Fregean or Frege-Churchian is actually his own formalisation of

Frege's ideas. Throughout Kaplan works in the possible worlds framework and deals with the formal, model theoretic aspects of the theory: the intuitive understanding of the theory is not addressed.³

The ontology underlying Russell's semantics consists of individuals, propositions and propositional functions. Russellian semantics, in one formulation, also makes use of attributes, which are special kinds of propositional functions. Kaplan describes attributes as relations in intension; although we can think of relations as things, once we have pulled them out of propositions we have destroyed their intensionality. An attribute, therefore, is (the semantic value of) a verb "in place" in a proposition, the verb plus the mysterious glue with which it binds individuals and itself into a proposition.

For Russell, for example, the only basic intensional notion seems to be that of an attribute (or relation in intension). Propositions and propositional functions (which are distinct from attributes) are constructed from these and individuals. (Kaplan, 1975, p. 719)

For Russell, an attribute combines with an individual to yield a (singular) proposition (here the Haecceitism comes into play). This suggests that an attribute can be represented as a function from individuals to propositions, that is, as the simplest kind of propositional function. (Kaplan, 1975, p. 728)

Attributes are the source of the intensionality, but by reconstruing them and inverting the dependency between them and propositions, we can represent attributes as propositional functions and thereby transfer the intensionality to propositions.

The ontology of the Frege-Church semantics consists of individuals, truth values, senses, and n -place functions to entities of any kind.⁴ The main task here, in reducing the ontology to the subpart corresponding to the Russell's, is to reduce senses. This enumeration of the Frege-Church ontology does not mention propositions, but if we identify propositions with the senses of sentences, we can relate the two ontologies. Truth values drop out of the theory if we move up a level in the intensional hierarchy to the level of senses of first order entities; in particular

propositions, though conceived differently from Russell, can be used to reduce the other entities. In the Frege-Church system, an atomic proposition consists of an attribute (the sense of a predicate) and individual concepts, whereas for Russell it was an attribute and individuals. Although the components are different, the Frege-Church proposition has the same structure as the Russellian proposition. Hence, if we can reduce the components, we shall have reduced the Frege-Church notion of a proposition to the Russellian one.

A remark on Kaplan's terminology, which I shall adopt, would be illuminating. Although Kaplan speaks of 'reducing' the 'ontology' of the Frege-Church theory, what he actually does is to reformulate the theory, reorganising the relations between the various semantic entities.

At this point I need to say something about how propositions are being conceived. For Russell an atomic proposition consists of an attribute and individuals; thinking of propositions like this, as Russell did, we take individuals and attributes as primitive -- not propositions. We are conceiving of Frege-Church propositions in the same manner, except that individual concepts replace individuals. In his formal reduction, however, Kaplan, who is working within the possible worlds framework, takes individuals and possible worlds as primitive, constructs propositions as sets of possible worlds, and then constructs (Russellian) attributes as functions from individuals to propositions. Thus he has a very different representation of propositions, attributes, and how the constituents of propositions are related.

The constituents of Frege-Church propositions are senses; an attribute is the sense of a predicate, and an individual concept is the sense of an individual. The possible worlds framework again induces Kaplan, in his reduction, to take individuals and possible worlds as primitive, construct propositions in the usual manner, then to reduce individual concepts as follows. In the possible worlds notation an individual concept is a function from worlds to individuals: given a world it either picks out a unique individual, or is undefined. This means that individual concepts can be

represented as functions from individuals to propositions: an individual concept c is represented by the function f_c from individuals to sets of possible worlds (ie. propositions) defined by:

$$f_c(x) = \{ w \mid c(w) = x \}.$$

The Frege-Church attribute is simply represented by a function from individual concepts to propositions.

Kaplan is able to reformulate both the Russellian and Frege-Church theories in a possible worlds framework, with individuals and possible worlds as primitives. In addition to the primitives, the reformulated theories each make use of propositions and propositional functions, with propositions the repository of intensionality. The reformulation of the Russellian ontology requires only propositional functions whose domain consists of n -tuples of individuals, but the reduction of the Frege-Church ontology requires in addition propositional functions whose domain contains other kinds of entity.

The ontology underlying Richards' semantics includes individuals, predicate letters and function letters. Propositions for Richards are rather strange entities, built out of individuals, predicate letters and function letters by the operation of linguistic concatenation. In so much as they are constructions from more basic entities, they are not presumed by the ontology of the theory, but the operation of concatenation is performing the same role here for Richards as the "mysterious glue" that binds things together in propositions does for Russell. Richards thereby claims that the relation between a predicate (what Russell called the 'verb') and an attribute (a verb "in place", a predicate in use in a sentence) is linguistic.

We could carry out an analysis in Kaplan's style on Richards' theory too, although it is questionable whether the exercise is not pointless. Since Richards' semantics is Russellian, the operation is basically the same as Kaplan's reformulation of Russell: we take individuals and possible worlds as primitives, construct propositions as sets of possible worlds, and then treat predicate letters as functions from n -tuples of individuals to propositions and function

letters as functions from n -tuples of individuals to individuals. This reformulation reduces predicate and function letters to objects within Kaplan's basic Russellian ontology, but it inverts which entities in the theory are primitive and which constructed. We have given up the explication of the relation of constituents within a proposition, and returned that relation to obscurity by assuming that we have examples of the whole entity (propositions), discerning some of their parts (individuals), and treating the remainder (attributes) simply as functions from individuals to propositions. In addition, the natural way of understanding Richards' semantics avoids having to regard possible worlds as primitives.

6.2 Application to situation semantics

6.2.1 The Ontology of Situation Semantics

The ontology underlying situation semantics consists of individuals, properties, locations, and truth values.⁵ Out of these Barwise and Perry construct an enormous number of other kinds of entities that are employed in the semantics. In the first instance, we shall be concerned only with situations, but later we shall need to consider some of the other constructed entities. Perhaps most conspicuous is the addition of properties⁶ and locations to the ontology. For the present we shall concentrate on the role of properties in the semantics, since there is plenty of restructuring to be charted with their addition alone.

The ontology of situation semantics includes truth values, unlike Russell's, but like Frege's theory. However, truth values have a significantly different role in situation semantics than they have in the Frege-Church theory. whereas there they function as the references of sentences, in situation semantics they are neither the references of sentences, nor the references of anything else: their role, rather, is bound up with the representational (or modelling)

status of the formalism.

To see what is going on, let us consider an extremely simple situation, that in which the only thing happening is that at a location l, Jackie is biting Molly:

$e :=$ at l: biting, Jackie, Molly; yes

or, in a more formal notation, the situation $e = \{\langle \underline{l}, \langle \text{biting, Jackie, Molly} \rangle, 1 \rangle\}$.⁷ The five ultimate components of the situation are all primitive entities, the situation being a set theoretic construct. In contrast to, say, the Russellian theory, where there is something basic and irreducible about the proposition itself, having to do with how the constituents are related within it, the (abstract) situation in situation semantics is not basic.

The Russellian or reduced Frege-Church notion of a proposition corresponds in a way more closely with the notion of a real situation or Russell's facts. There are no truth values involved in the real situation, and the relation among its constituents is similarly unclear and mysterious. Barwise and Perry regard their set theoretic entities as apparatus that is introduced in the classification of real situations: the truth values enter the formalism in this context.⁸ However, although they take this view, it is the formalism that is used to do the semantics of natural language, and which usurps the main role.⁹

If we regard abstract situations as propositions, and we have argued that we can, then the set theory in Barwise and Perry's semantics has clearly taken on the main task of relating constituents within propositions; but the truth value does have a role to play in this. As Russell pointed out, there are two propositions corresponding to each fact; in the case of Jackie's biting Molly, there is the proposition one expresses by uttering 'Jackie is biting Molly', and the other one, expressed by uttering 'Jackie is not biting Molly'.¹⁰ We can represent these two propositions using abstract situations differing only in which truth value they contain. For Russell, the constituents of both propositions are the same, but they are differently related. The truth value in situation

semantics, therefore, takes over part of the work done by the relation of the constituents within the proposition on the other picture.

Situations are normally represented as sets of situational sequences $\langle \underline{l}, \underline{y}, \underline{i} \rangle$. They can also be regarded as total functions from sequences $\langle \underline{l}, \underline{y}, \underline{i} \rangle$ to truth values, simply by moving from the set to its characteristic function. For example, the situation above which has Jackie biting Molly would be represented by the total function $\underline{f}: \text{Seq} \rightarrow \{0,1\}$, where Seq is the class of all sequences $\langle \underline{l}, \underline{y}, \underline{i} \rangle$, defined by:

$$\underline{f}(\underline{s}) = \begin{cases} 1 & \text{if } \underline{s} = \langle \underline{l}, \langle \text{biting, Jackie, Molly} \rangle, 1 \rangle \\ 0 & \text{otherwise.} \end{cases}$$

for all $\underline{s} \in \text{Seq}$. We have not thereby eliminated the curious role of the truth value in the specification of a situation. In fact, we are now dealing with two kinds of occurrences of a truth value, once as the \underline{i} in the sequence $\langle \underline{l}, \underline{y}, \underline{i} \rangle$, and again as the values of the characteristic function. However, this second kind of occurrence of a truth value is due merely to the representation of sets as characteristic functions; moving back to representing situations as sets eliminates it. This should make us think about the first kind of occurrence of a truth value -- is it also eliminable?

There is another way of thinking of situations: we could take the truth value \underline{i} as the value which a partial function assigns to sequences $\langle \underline{l}, \underline{y} \rangle$. With this representation of a situation, however, we do not obtain a characteristic function, because this new function is only partial and, crucially, we are interested not only in the sequences $\langle \underline{l}, \underline{y} \rangle$ to which it assigns 1, but also those to which it assigns 0. We cannot eliminate this first occurrence of a truth value by moving to a set, for the function is not simply characterising a subset of its domain. However, we can represent a situation as a pair of sets, the members of each set being themselves pairs $\langle \underline{l}, \underline{y} \rangle$. Intuitively, the first set of pairs is the set of those

pairs which, on the partial functional representation of abstract situations, are mapped to 1, and the second set consists of those mapped to 0. For example, the situation above with Jackie biting Molly would be represented by the pair

$$\langle \{ \langle \underline{l}, \langle \text{biting}, \text{Jackie}, \text{Molly} \rangle \rangle \}, \emptyset \rangle$$

and the situation

$\underline{e} :=$ at \underline{l} : \underline{r} , \underline{a} , \underline{b} ; yes

\underline{r}' , \underline{a} ; no

at \underline{l}' : \underline{r}'' , \underline{a} , \underline{c} ; yes

would become

$$\langle \{ \langle \underline{l}, \langle \underline{r}, \underline{a}, \underline{b} \rangle \rangle, \langle \underline{l}', \langle \underline{r}'', \underline{a}, \underline{c} \rangle \rangle \}, \{ \langle \underline{l}', \langle \underline{r}', \underline{a} \rangle \rangle \} \rangle.$$

We have eliminated truth values from the representation of abstract situations altogether. Nonetheless, this reformulation of the representation of abstract situations should make clear what the role of the truth value in situation semantics is.

The "truth value" does not signify that something is the case or is not the case. Unlike the role of the truth value in Fregean semantics, where if a sentence designates 1 it is true, in situation semantics the "truth value" is simply a means of classifying pairs $\langle \underline{l}, \underline{y} \rangle$ in one of two ways without being committed to the truth of those relations classified with 1; "truth" is relative to the abstract situation involved and abstract situations can be non-factual, even incoherent. Contact with reality occurs only at the level of the structure of situations. The role of the "truth values" 0 and 1 in situation semantics is thus very different from the role which they have in Fregean semantics.

Reformulating situation semantics in the attempt to make it conform with the Russellian ontology of individuals, propositions, and propositional functions, we have to allow locations as well. This should be unobjectionable; Kaplan has places and times in his theory (Kaplan, 1979), and when indexicality is accepted as something

to be accounted for, locations seem natural and inevitable. Whereas Kaplan constructs propositions from possible worlds, it seems more natural that in reformulating the ontology of situation semantics we should construct propositions from "possible situations". But what are these possible situations? They cannot be abstract situations, since the point of the reduction is to eliminate properties and abstract situations are constructed out of properties and other primitives. Nor can they be real situations, for there are not enough of these. (Hence my motivation for calling them possible situations -- they must be distinguished from both abstract situations and real situations.) In the possible worlds framework Kaplan employs, possible worlds are primitive; we could similarly take possible situations as primitive, but there is a more desirable alternative. Since possible situations could be constructed from possible worlds by thinking of a possible situation as a set of possible worlds,¹¹ we can dispense entirely with the notion of possible situations and construct propositions directly from possible worlds. Indeed, since both propositions and possible situations can be constructed from possible worlds, what is the difference between them?

One might be inclined to think that properties can now be represented as functions which map a location and a sequence of individuals to a proposition; this is not so, for we have forgotten truth values. In the theories Kaplan deals with, negation is like conjunction and disjunction: a sentential operator; in situation semantics, however, Barwise and Perry treat only VP negation, so that we have to handle propositions such as that Jackie is (definitely) not biting Molly, in addition to the proposition that it is not the case that Jackie is biting Molly. A property can be combined with a location and a sequence of individuals to yield two distinct abstract situations:

$$\langle \underline{l}, \underline{r}, \underline{a}_1, \dots, \underline{a}_n, 1 \rangle$$

$$\langle \underline{l}, \underline{r}, \underline{a}_1, \dots, \underline{a}_n, 0 \rangle$$

The proposed representation of properties as a function from a

location and a sequence of individuals to a proposition is therefore too coarse.

The simplest solution is to represent properties as functions from locations, sequences of individuals and "truth values" to propositions. It is also possible to use the method of eliminating the "truth value" outlined above, if one does not like this reference to "truth values"; the elements in the domain of these functions which represent properties will be more complex in this case, but there is no essential difference. For example, employing "truth values", a property \underline{r} is represented by a function \underline{f}_r :

$\underline{f}_r(\underline{l}, \underline{a}_1, \dots, \underline{a}_n, 1) =$ the proposition that $\underline{a}_1, \dots, \underline{a}_n$ stand in the relation \underline{r} at \underline{l} .

$\underline{f}_r(\underline{l}, \underline{a}_1, \dots, \underline{a}_n, 0) =$ the proposition that $\underline{a}_1, \dots, \underline{a}_n$ (definitely) do not stand in the relation \underline{r} at \underline{l} .

Alternatively, the function may be written as follows, eliminating reference to "truth values":

$\underline{f}_r(\langle \underline{l}, \underline{a}_1, \dots, \underline{a}_n \rangle, \emptyset) =$ the proposition that $\underline{a}_1, \dots, \underline{a}_n$ stand in the relation \underline{r} at \underline{l} .

$\underline{f}_r(\emptyset, \langle \underline{l}, \underline{a}_1, \dots, \underline{a}_n \rangle) =$ the proposition that $\underline{a}_1, \dots, \underline{a}_n$ (definitely) do not stand in the relation \underline{r} at \underline{l} .

The ontology is thereby reformulated in terms of individuals, locations, and propositions.¹²

6.2.2 The addition of necessity and possibility to situation semantics

In order to carry through a full analysis, we need to be able to consider in situation semantics sentences of the form 'Necessarily \underline{S} ' ($\Box \underline{S}$; henceforth I shall use the box \Box to represent necessarily and the diamond \Diamond to represent possibly). This is something we cannot do with the Barwise and Perry theory as it is at present, therefore I have extended that theory by adding to it a semantics for

necessity and possibility. In all this I shall treat both \Box and \Diamond as sentential operators. Although I deal with both notions, one is not thereby prevented from either defining one in terms of the other, or taking both primitively, as one pleases.

To prepare the way for our analysis of necessity and possibility, consider the following point about the sentence connective $\&$. Usually in model theoretic semantics the truth conditions for atomic sentences are defined first and then the truth conditions of molecular sentences are recursively defined in terms of their parts. In the case of $\&$, the clause defining the connective would be:

$$\mathcal{Q} \models \underline{S} \& \underline{T} \text{ iff } \mathcal{Q} \models \underline{S} \text{ and } \mathcal{Q} \models \underline{T}.$$

Now, in situation semantics, we could keep this clause; however, because sentences (more exactly, utterances) designate classes of situations, there is another method open to us for defining the truth conditions of a molecular sentence $\underline{S} \& \underline{T}$ than in terms of the truth conditions of its subsentences. The truth conditions of $\underline{S} \& \underline{T}$ can be given directly:

$$\mathcal{M} \models_{d,c} \underline{S} \& \underline{T} \text{ iff } (\exists e)(e \in (M_0 \cap d,c \llbracket \underline{S} \& \underline{T} \rrbracket)).$$

We can do this because $\underline{S} \& \underline{T}$ has a meaning and an interpretation of its own, a relation between utterance situations d,c and described situations e . Situation semantics is very much concerned with linguistic meaning, and it is this meaning that is recursively defined, rather than the truth conditions or reference.¹³ Of course, care is taken so that $\llbracket \underline{S} \& \underline{T} \rrbracket$ is defined in such a way that the two definitions agree.

We might expect the same two possibilities to be open to us in adding necessity and possibility to the semantics. To set out the two possibilities, we have, firstly, the conventional (indirect) approach, here formulated in the usual possible worlds notation:

$$(1) \quad \mathcal{Q} \models_w \Box \underline{S} \text{ iff } (\forall w')(w' \in W \& wRw' \rightarrow \mathcal{Q} \models_{w'} \underline{S})$$

$$(2) \mathcal{Q} \models_w \Diamond S \text{ iff } (\exists w') (w' \in W \& wRw' \& \mathcal{Q} \models_{w'} S)$$

The sentence $\Box S$ is true in a world w iff the sentence S is true in all accessible possible worlds w' ; $\Diamond S$ is true in w iff S is true in at least one accessible possible world w' . Now, we do not have possible worlds in situation semantics; nonetheless, this definition suggests how we might deal with necessity and possibility using classes of possible actual situations. I will show how to incorporate this "possible worlds" conception of necessity into situation semantics.

There is another way to provide a semantics for necessity by defining $d, c \models [\Box S] e$, which may seem more in the spirit of situation semantics.¹⁴ On this approach we introduce the notion of a possible option, which is a relation between two abstract situations. We shall write $ePOe'$ to mean that e' is a possible option from e ; the import of this notion is that if e is actual, then the world, or part of it, might be (or might have been) like e' : e' is possible. The relation PO between situations is analogous to the relation of accessibility between possible worlds. We shall also write $e' \in PO(e)$ for $ePOe'$ and use $PO(e)$ for the class of abstract situations possible relative to e . The meanings of $\Box S$ and $\Diamond S$ are then

$$(3) d, c \models [\Box S] e \text{ iff } (\forall e') (e' \in PO(e) \rightarrow d, c \models [S] e')$$

$$(4) d, c \models [\Diamond S] e \text{ iff } (\exists e') (e' \in PO(e) \& d, c \models [S] e')$$

I shall now define the notions of necessity and possibility in the way promised, which encodes the possible worlds conception of these notions; then I shall show that it and the way just outlined are equivalent.

We do not have possible worlds in situation semantics; in fact, we do not even have an actual world in the semantics as laid down in Situations and Attitudes. What we do have are actual situations. A model \mathcal{M} is an ordered pair $\langle M, M_0 \rangle$, where M_0 is a class of actual situations and M is the class of corresponding factual situations. (In fact, it is redundant to mention M in specifying the model, since the definition of truth mentions only M_0 , and the constraints on M and M_0 mean that M can be derived from M_0 .) The class M_0 specifies

the way the world is, and thus plays the same part as the distinguished member \underline{G} of the set of possible worlds \underline{K} in Kripke's (1963) notation. This suggests that we can capture necessity by expanding the concept of a model, so that there are not only classes \underline{M} and \underline{M}_0 , the factual and actual situations, but a family of pairs $\langle \underline{N}_\mu, \underline{M}_\mu \rangle$ of "possible factual" and "possible actual" situations respectively, with a distinguished pair, written $\langle \underline{N}_0, \underline{M}_0 \rangle$, which tell us the way the world is.

In the first stage of extending the model theory, we assume that in all possible states of the world (all possible worlds) the same individuals, properties and locations occur. (This assumption will simplify the analysis; later we shall drop it.) A stage one model is a triple $\langle \underline{M}_0, \mathcal{M}, \mathcal{R} \rangle$ ¹⁵, where \mathcal{M} is a family of classes \underline{M}_μ of abstract situations (the classes of possible actual situations), \underline{M}_0 is a distinguished member of \mathcal{M} , and \mathcal{R} is a relation of relative accessibility between classes \underline{M}_μ . Given classes \underline{A} , \underline{R} , and \underline{L} of individuals, relations and locations respectively, and a class \mathcal{E} of all abstract situations generated from them, each $\underline{M}_\mu \in \mathcal{M}$ will determine a subclass \underline{N}_μ of \mathcal{E} of factual situations. Naturally, for each class $\underline{M}_\mu \in \mathcal{M}$, the pair $\langle \underline{N}_\mu, \underline{M}_\mu \rangle$ will have to satisfy certain conditions, namely Barwise and Perry's four conditions on models (S&A, p. 60).

The concept of necessity we are to formulate requires us to relativise the notion of truth to a class \underline{M}_μ and to think of utterances being true with respect to possible states of the world. States of the world are specified by the classes $\underline{M}_\mu \in \mathcal{M}$. We will signify that a sentence \underline{S} uttered on an occasion represented by $\underline{d}, \underline{c}$ is true relative to the class \underline{M}_μ in a model $\mathcal{J} = \langle \underline{M}_0, \mathcal{M}, \mathcal{R} \rangle$ by writing

$$\mathcal{J} \models_{\underline{d}, \underline{c}}^{\underline{M}_\mu} \underline{S}.$$

(I shall use a Gothic letter \mathcal{J} rather than \mathcal{U} for the new situation semantics models.) The definition of truth in the distinguished class \underline{M}_0 remains the same as it was: in our new notation this becomes

$$(5) \quad \mathcal{J} \models_{\underline{d}, \underline{c}}^{\underline{M}_0} \underline{S} \text{ iff } (\exists \underline{e})(\underline{e} \in \underline{M}_0 \cap \underline{d}, \underline{c} \Vdash \underline{S})$$

Truth relative to an arbitrary class $M_\mu \in \mathcal{M}$ is similar, as one would expect, and is given below as (6). Finally, the truth of a sentence $\Box \underline{S}$ relative to an arbitrary class $M_\mu \in \mathcal{M}$ is given by (7):

$$(6) \quad \mathcal{V} \models_{d,c}^{M_\mu} \underline{S} \text{ iff } (\exists e)(e \in (M_\mu \cap d, c \models \underline{S}))$$

$$(7) \quad \mathcal{V} \models_{d,c}^{M_\mu} \Box \underline{S} \text{ iff } (\forall \nu)(\nu \in m \ \& \ M_\mu R M_\nu \rightarrow \mathcal{V} \models_{d,c}^{M_\nu} \underline{S})$$

Clause (7) incorporates the a relation R of relative accessibility between classes $M_\mu \in \mathcal{M}$.

To show that this conception of necessity and possibility, which I shall call 'the PW conception', is formally equivalent to that embedded in the semantics via definitions (3) and (4), which represent what I shall call 'the SS approach', we need to relate the model theoretic apparatus of the pairs $\langle N_\mu, M_\mu \rangle$ that we have here to the possible options apparatus of the SS approach.

We mean by $e' \in PQ(e)$ that if e is actual ($e \in M_0$), then the state of the world specified by e' is possible. What does this mean in the PW approach? An important qualification is that $e' \in PQ(e)$ need not be a possible actual situation in PW terminology, it might be merely a possible factual situation: we require $e' \in N_\mu$, but not necessarily $e' \in M_\mu$. Formally, therefore, we have:

$$(\forall e')((\exists e)(e \in M_0 \ \& \ e' \in PQ(e)) \rightarrow (\exists \mu)(\mu \in m \ \& \ M_0 R M_\mu \ \& \ e' \in N_\mu))$$

The PW conception of possibility revolves around the notion of accessibility between total specifications of the state of the world by means of the classes M_μ : $M_0 R M_\mu$ means that the state of the world specified by M_μ (effectively the situations in N_μ) is possible, given that M_0 is the actual state of the world. If $e' \in N_\mu$, it is a possible state of the world, so that we require e' to be a possible option from some actual situation, thus:

$$(\forall e')((\exists \mu)(\mu \in m \ \& \ M_0 R M_\mu \ \& \ e' \in N_\mu) \rightarrow (\exists e)(e \in M_0 \ \& \ e' \in PQ(e)))$$

Combining these two conditionals we have, therefore:

$$(8) (\forall e')((\exists e)(e \in \underline{M}_0 \ \& \ e' \in \underline{PO}(e)) \leftrightarrow (\exists \mu)(\mu \in m \ \& \ \underline{M}_0 \underline{RM}_{\mu} \ \& \ e' \in \underline{N}_{\mu}))$$

which forms the basis for proving the equivalence of the two systems.

We shall demonstrate the equivalence with respect to possibility, by showing that the truth conditions for an utterance of $\Diamond\varphi$ at $\langle d, c \rangle$ are equivalent. On the SS approach we have:

$$\begin{aligned} (9) \quad \mathcal{I} \models_{d,c}^{\underline{M}_0} \Diamond\varphi \\ \Leftrightarrow (\exists e)(e \in (\underline{M}_0 \cap d, c \llbracket \Diamond\varphi \rrbracket)) \\ \Leftrightarrow (\exists e)(e \in \underline{M}_0 \ \& \ (\exists e')(e' \in \underline{PO}(e) \ \& \ d, c \llbracket \varphi \rrbracket e')) \\ \Leftrightarrow (\exists e')(\exists e)(e \in \underline{M}_0 \ \& \ e' \in \underline{PO}(e) \ \& \ d, c \llbracket \varphi \rrbracket e') \end{aligned}$$

On the PW approach we have:

$$\begin{aligned} (10) \quad \mathcal{I} \models_{d,c}^{\underline{M}_0} \Diamond\varphi \\ \Leftrightarrow (\exists \mu)(\mu \in m \ \& \ \underline{M}_0 \underline{RM}_{\mu} \ \& \ \mathcal{I} \models_{d,c}^{\underline{M}_{\mu}} \varphi) \\ \Leftrightarrow (\exists \mu)(\mu \in m \ \& \ \underline{M}_0 \underline{RM}_{\mu} \ \& \ (\exists e')(e' \in \underline{M}_{\mu} \cap d, c \llbracket \varphi \rrbracket)) \\ \Leftrightarrow (\exists e')(\exists \mu)(\mu \in m \ \& \ \underline{M}_0 \underline{RM}_{\mu} \ \& \ e' \in \underline{M}_{\mu} \ \& \ d, c \llbracket \varphi \rrbracket e') \end{aligned}$$

The equivalence of the last lines from each of (9) and (10) follows from (8).

This equivalence shows that the model theory of situation semantics, for all its strangeness, is fundamentally not so different from standard model theory. Embedding the concepts of possibility and necessity within situation semantics in the natural situational way (our SS approach) is equivalent to the standard possible worlds conception of the notions (which was formalised by our PW approach).

In possible world semantics, there are generally possible individuals considered to exist in other possible worlds which do not exist in the actual world -- Pegasus, for example. If we are going to incorporate this feature into our semantics, we must let $\underline{M}_{\mu} \in \mathcal{U}$ determine the class \underline{A}_{μ} of individuals that would exist in the world, if the actual situations were just as \underline{M}_{μ} specifies. Similarly, if we

thought it necessary or desirable for the actual properties and locations we find in the world not to be fixed, but also to vary, if the world were different, M_μ would additionally determine classes R_μ and L_μ . A stage two model, which I shall not develop here, but leave to the reader, would incorporate these features. suffice it to say that allowing this variation in which individuals there are (and perhaps also which properties and locations there are) does not affect the basic structure of the definition of truth in terms of the interpretation, which remains as it is above, in (6) and (7).

The acceptance of singular propositions entails haecceitism. We have argued that abstract situations correspond to propositions; now, an abstract situation contains individuals themselves (the "bare" individuals), so situation semantics is committed to singular propositions. Therefore the semantics is haecceitist. Although we do not have possible worlds in situation semantics, we have the classes M_μ of possible actual situations, and we might wonder whether an individual $a \in A_\mu$ is identical with another $a' \in A_\nu$. To be faithful to Barwise and Perry's approach, the set of all possible individuals is the set $A = \bigcup_\mu A_\mu$; all individuals are present at once, so that $a \in A_\mu$ is $a' \in A_\nu$ if and only if $a = a'$. Any overlaps are metaphysically real, and the semantics is haecceitist.

6.2.3 Where is the intensionality located?

An interesting question to put to situation semantics is: Where is the intensionality located in the theory? In investigating this matter, for which the analysis of the previous section is helpful, I shall also consider, for comparative purposes, the location of intensionality in the other theories we have been looking at -- Russell's, Richards', and the Frege-Church theory. First let us see what the concept of intensionality involves.

Primary examples of intensionality occur with modal contexts and attitude reports: verbs of propositional attitude are regarded as intensional operators, creating intensional contexts. Intensionality

is made the explanation for the failure of the principle of substitution of coreferential singular terms, as in

(11) The ancient Egyptians believed the Morning Star was visible in the morning.

(12) The ancient Egyptians believed the Evening Star was visible in the morning.

Intensionality in Fregean theory is located at the level of sense, and thus comes into play in any context where the sense of an expression is made to function as its semantic value.

It has been supposed that what is needed to deal with intensionality is a more refined concept of meaning (for the semantic explanation of the failure of substitutivity is that distinct singular terms introduce distinct references, when there is only one physical object). The machinery of possible world semantics is an attempt to grasp such a finer notion of meaning. In an extensional semantics, where the meaning of a predicate F is its extension, a set of individuals, it is impossible to distinguish semantically between coextensive predicates F and G, for they are assigned the same set of individuals. If it is contingent that F and G are coextensive, so that they might not have been so, then an intensional semantics can distinguish between them, for the meaning of a predicate in such a semantics may be identified with a function from possible worlds to sets of individuals, and F and G will not be assigned the same function, for by hypothesis in some possible worlds at least, they will have different extensions.

Since for Russell the proposition is a complex consisting of an attribute and individuals, if either an individual or the attribute is exchanged for another, different one, the resulting proposition is distinct. Thus different terms which designate the same individual can be substituted without changing the proposition expressed by the containing sentence, for only that individual, and not the terms themselves, is a constituent of the propositions. The expectation of this is what gives rise to the puzzle of opacity in intensional contexts. If a language contained coreferential verbs or predicates,

they too could be interchanged without altering the proposition expressed.

We can illustrate this point in Richards' theory, where predicates of the formal language L are interpreted as the attributes of the proposition. For example, the two embedded sentences in

(13) Galileo said that the Earth moves.

(14) Galileo said that the Earth orbits.

are represented differently in a language $L(\mathcal{P}, \mathcal{Y}, \mathcal{L})$, for which the sets \mathcal{P} , \mathcal{Y} and \mathcal{L} contain a suitable number of entities or the right kind for our example. Following Richards closely (Richards, 1974, p. 437), the propositions are, respectively,

(15) Said(c_1 , F(Moves(c_2)))

(16) Said(c_1 , F(Orbits(c_2)))

where c_1 is Galileo, c_2 is the earth, F is interpreted as 'that', and Said, Moves, and Orbits are interpreted as 'said', 'moves' and 'orbits' respectively.

For a given object language, there will be some languages $L(\mathcal{P}, \mathcal{Y}, \mathcal{L})$ such that we can find a one to one mapping between of the predicates $P_k \in \mathcal{P}$ of L and the verbs V_k in the object language such that if p is a proposition expressed by a sentence $S(V_k)$ in which V_k occurs and V_k is mapped to P_k , then there is a formula φ_k of L which also expresses the proposition p and P_k occurs in φ_k . In these cases the intensionality is located with the predicates. It appears that this is intended in Richards' theory. But the intensionality is located there, because that is where Richards has decided to place it. The pragmatic part of his theory is designed to get away from the many various object language expressions that can designate a single individual, and to deliver the individual itself as the input to the semantic component. Nothing similar is the case with predicates and verbs.¹⁶ We can imagine extending the pragmatic component so that utterances were scrutinised also with respect to the verbs employed; if there were a canonical representation for the

concepts expressed by verbs, then we could use these as the predicates of \underline{L} and in certain cases utterances of sentences which contain distinct verbs would nonetheless express exactly the same proposition (thought of as a formula of \underline{L}). Suppose $G(x)$ is a predicate (perhaps expressed in the language of physics) that is satisfied by the earth in virtue of its revolutions around the sun; then the proposition expressed by utterances of each of (13) and (14) would be represented thus: $\text{Said}(\underline{c}_1, F(G(\underline{c}_2)))$.¹⁷

From this perspective situation semantics is a theory of considerable interest, for it takes properties to be primitive, and abstract situations are constructed out of them. If we had two utterances which, although utilising different verbs in the object language, referred to one and the same property, the same proposition would be expressed in each case. Unfortunately, however, it seems that we are far from having a set of canonical properties; properties seem to be proliferated when required, one corresponding to each object language verb. This remark applies to the ecological psychologists as much as to Barwise and Perry.

Barwise and Perry have acknowledged the influence of Gibsonian or ecological psychology on their metatheory, and the question of where the intentionality is located has been asked with respect to ecological psychology (Fodor and Pylyshyn, 1981), so the issue is worth considering here. Properties in Gibson's work (and the same is true of situation semantics) are intentional, since the notion of property identity goes beyond extensions (which individuals have the property): coextensive sets may be the extensions of distinct properties.¹⁸ In the context Fodor and Pylyshyn consider, the problem of intensionality manifests itself in the fact that an object can enter into cognitive behaviour as a causal factor in different guises -- as the Morning Star or as the Evening Star, for example.

Fodor and Pylyshyn argue that we should use mental representations to deal with intentionality, but Gibson, they say, eschewing mental representations, is attempting to deal with the problem by 'proliferating properties'. They locate the intentionality in Gibson's theory firmly with the properties. A

single astronomical object, Venus, has two presently relevant properties: the property of being the Morning Star and the property of being the Evening Star. When the ancient Egyptian astronomers observed Venus in the morning and had thoughts about it, on Fodor and Pylyshyn's view they were internally representing it as the Morning Star; but on the Gibsonian view they were perceiving it as instantiating the property of being the Morning Star. Properties have taken over the intentional role that is performed by mental representations in cognitive science theories.

6.3 Almog's recent theory

Joseph Almog (1983) has placed the direct reference theory in its historical context, extended the theory, and explained its significance as he sees it, thus making that paper an important contribution to one of our central issues: the status of the semantic entities. Almog sees as a particularly important aspect of Kaplan's views the separation of how the meaning of an expression determines its referent from the modal value of the expression; for Fregeans, sense is expected both to determine reference and represent the modal value of an expression.¹⁹ According to Almog, Kripke and Putnam do not depart from this basic Fregean picture, despite their original contributions to the causal theory of names and natural kind terms. A considerable body of work in the Fregean tradition has emerged, incorporating the Kripke-Putnam criticisms of description theories, and which Almog dubs as the neo-Fregean survival.

Kripke and Putnam argued against the description theory as a picture of how the references of names and natural kind terms are determined. The new theory, for the pictures of reference that Kripke and Putnam offer are in the relevant respects the same, is a causal theory. The description theory of names went hand in hand with a Fregean semantics -- the sense of a name was the associated group of descriptions, which determined which individual was the bearer of the name.

The causal theory of names teaches that a name is attached to an individual at a "baptism" (Kripke, 1972; Devitt, 1974, 1981); that that individual is the referent of the name, and that reference is preserved (under normal circumstances) via the series of links that results as more and more speakers learn the name, either directly from those who were present at the baptism (or have otherwise been in physical contact with the referent²⁰), or indirectly from other speakers who have learned the name. There is thus a chain of connections from current users of a name all the way back through history to the referent.

The relation between names and descriptions within the causal theory is the reverse of what it was with the descriptive theory; the name 'Aristotle' does not refer to Aristotle in virtue of descriptions associated with it, eg. the teacher of Alexander. Rather, there is a causal chain reaching back from our use of the name today to Aristotle himself.

Hilary Putnam has argued that essentially the same mechanism determines the references of natural kind terms: 'water', 'gold', 'lemon', 'tiger', etc. The reference of 'water' is not whatever satisfies the description 'the stuff that fills rivers and lakes, that animals drink, etc.', since on Twin Earth XYZ satisfies this compound description, but is not water; rather, 'water' refers to all samples of liquid which share the essence as the liquid which the term 'water' was first used to name, and which (we believe) is water: H₂O. Natural kind terms are in a certain sense indexical.

The problem with the Fregean theory, given the general acceptance of Kripke's and Putnam's arguments for the stability of names and natural kind terms, is that the senses of these expressions would designate, in other possible worlds, other individuals and other natural kinds. The neo-Fregean response, therefore, has been to modify the senses of such expressions accordingly, to rigidify, apriorise and socialise senses, as Almog states (Almog, 1983, p. 11). The sense of the name "Kripke" in neo-Fregean theory is:

The actual individual standing at the end of the chain

leading to the actual use by the agent of "Kripke".
(Almog, 1983, p. 11)

Almog considers this neo-Fregean survival as indicative of the failure of Kripke's and Putnam's arguments to tackle the roots of Fregean theory; he improves on their arguments by proposing a fundamentally different mechanism for reference. With Kripke and Putnam, the referents of names and natural kinds is seen to be determined not by description, the Fregean stratagem, but by causal chains; but this is demonstrated by a consideration of various examples involving other possible worlds or Twin Earth, ie. by considering the modal properties of these expressions. In contrast, Almog remarks, Kaplan's work is distinguished by a concentration firstly upon the mechanism of reference, the modal properties of expressions arising as a corollary.

Using the semantics of necessity and possibility developed in section (6.2.2), I intend to explore the relation between reference and modality in situation semantics. Finally, I want to point out similarities between situation semantics, Almog's views on the future of direct reference theory, and Robin Cooper's recent work on sentence negation in situation semantics, discussed in the previous chapter.

6.3.1 The mechanism of reference

There are several points about Almog's view of the direct reference theory that we must understand. The first point concerns the determination of which proposition is expressed by an utterance. A sentence uttered in a context (or taken with respect to a context) expresses a proposition. If we employ the possible worlds idiom,²¹ and thus regard modal operators as shifting evaluation to other possible worlds, then for Almog, as for Kaplan (1977), such shifts can happen only after the proposition has been determined, or at least only after the contributions of directly referring expressions have been determined, and it is always this same proposition, fixed

once and for all, that is evaluated at these other worlds.²²

This is the view that Kaplan's work on demonstratives and indexicals has given rise to. Almog, correctly in my opinion, believes it crucial to distinguish descriptive material operating as a sense and as a reference fixer (Almog, 1983, p. 22). The case of singular terms is more familiar and our intuitions clearer, so we shall consider that case, but Almog wants to extend this view to atomic predicates (cf. Almog, 1981, 1983, p. 45).

The reference of a name is not decided or determined by a function which returns individuals as values, even if it is the same individual in every possible world (or alternatively, every possible world in which the individual exists) -- the meaning of a name is not a constant intension, in other words. We have to relinquish any idea of reference fixing as a qualitative search through a domain for the appropriate individual. Such qualitative searches are in order for determining the truth or falsity of sentences containing bound variables: we are looking for an individual to make a sentence true (the existential quantifier), or we are checking that all individuals in the domain make the sentence true (the universal quantifier). Instead, directly referential terms are comparable to free variables (as Kaplan pointed out in the preface to 'Demonstratives', p. 2).

Rather an open sentence like 'Fx' is sensitive only to the assignment, an assignment which fixes an object for 'x'. The difference is crucial: the search through the domain of existents of a given world is a search which makes the extension of the formula (its truth value) dependent on facts of that world. The assignment is operating at a different level: it functions as a linguistic stipulation. As such it does not rely on facts. Rather it performs a decision to assign an object to a symbol, period. This decision comes before we look at any facts. (Almog, 1983, pp. 16,17)

The mechanism for fixing the reference of singular terms is a rule expressed in the metalanguage. This is Almog's strategy for getting away from reference being fixed by something like an intension, as for example with Kaplan's 'dthat' operator: the semantics of 'dthat(the F)', when represented in a possible worlds framework, as

found in Kaplan (1979), degenerates into a constant intension and is indistinguishable, as far as the representation is concerned, from something which happens to have the same extension in all possible worlds.

This view entails the reinstatement of singular propositions, because the reference fixing rules determine an individual, a "bare" individual and not an individual under a concept, as a constituent of the proposition expressed. For the Fregean there are no singular propositions; the proposition contains individual concepts as constituents. When we evaluate a Fregean proposition at a possible world, the individual concept determines an individual (supposing we do not have an empty term), the intension of the predicate determines an extension, and the utterance is true if the individual is in the extension. This is a different conception of a proposition and how the truth of an utterance is evaluated; we only contact individuals at the moment of evaluation. The direct reference view supposes that we can refer directly to an individual, and that when we do the individual himself becomes a constituent of the structure evaluated.

An example will help to show the difference between the direct reference view and Fregean theory. On the latter theory, terms refer to their referents via mediating senses, which have typically been viewed as operating as descriptive material. Hence, for our example, we shall focus on a description, 'Priam's eldest son'. According to the Fregean theory an utterance of

- (17) Achilles chased Priam's eldest son around the walls of Troy.

is true in a possible world if Achilles chased whoever is Priam's eldest son in that world around the walls of Troy.²³ In worlds where Hector is Priam's eldest son, the utterance is true (in such worlds) if Achilles chased Hector around Troy; in worlds where Aeneas is Priam's eldest son, the utterance is true if Achilles chased Aeneas around Troy. On the direct reference theory the proposition is determined before evaluation takes place: we find whoever is Priam's eldest son in the world of the context of the utterance, and that

individual becomes a constituent of the proposition expressed by the utterance. The mechanism whereby the reference of the definite description 'Priam's eldest son' is fixed, according to the direct reference theory as expanded by Almog, is that the atomic constituents of 'Priam's eldest son' refer directly to their references (pieces of the world): 'Priam' to Priam, 'son' to the property of sonhood, and 'eldest' to a function which maps the property of sonhood into the property of eldest sonhood. We obtain a complex property (being the eldest son of Priam) which Hector instantiates uniquely, so that the description refers to him. The proposition expressed by an utterance of (17) is accordingly that Achilles chased Hector around the walls of Troy. Hence, in each possible world, the utterance is true in that world if and only if in that world Achilles chased Hector around Troy, even if Priam's eldest son in that world is Aeneas.

In extending the direct reference view, Almog proposes that natural kind terms refer to the kinds in question, and that these kinds are constituents of the proposition expressed (see Almog, 1981, 1983, section 7): 'Propositions generated by "a is a(n) N" where "N" is a natural kind term, have the kind itself in the corresponding place.' (Almog, 1983, p. 47) Kind here means a property in the situation semantics sense, something that can be a part of a proposition. It is not surprising that where predicates are concerned, Almog begins with natural kind terms -- he had treated them in Almog (1981).

Care is taken throughout this paper to point out that one can share the direct reference view in semantics, and yet be anti-essentialist in metaphysics. One can hold that an utterance of

(18) Bagheera is a panther.

determines a proposition with Bagheera and the kind Panther as constituents; if one wants to, one can say that there are possible worlds where Bagheera does not stand in the kind membership relation to the kind Panther: this is a metaphysical question, not a semantical one.

Almog takes a new view about the role of causal chains in the determination of a proposition when a sentence is taken at a context. Whereas Kripke and Devitt see the role of causal chains as preserving and determining the references of expressions across speakers and times, for Almog their role is to preserve and determine the meaning of expressions. On Almog's view, causal chains have no semantic role; rather they have a pre-semantic task, operating on words qua pieces of syntax to give them meaning.

Kaplan's view in his (1977) was that linguistic meaning may be identified with the character of an expression, which is a function from contexts to contents. Almog retains this view, but locates the point of action of causal chains outside this sphere, so that causal chains now assign characters to expressions:

Rather, the chain decides which meaning "Kaplan" is going to have before we get to any context. It stipulates that the word is going to mean such-and-such. This is a pre-semantic task: we take syntactic shapes and decide which language [word] we are going to operate with. It is the stage where we can stipulate that "I" will mean: the-addressee-of-the-context, or "leg" will mean what "tail" standardly means. (Almog, 1983, p. 56)

Kaplan introduced a third level of meaning -- character -- into semantics; Almog (1984) proposes a fourth level, which he calls the level of interpretation (not to be confused with Barwise and Perry's use of this term). The interpretation of an expression is a function from a set of admissible dictionaries to characters; admissible dictionaries play the same role at this level as possible worlds play at the level of character. The fourth level is that at which the character of an expression is decided, 'the stage where we can stipulate that "I" will mean: the-addressee-of-the-context ...'. The idea is formalised in Almog (1984).

Situation semantics and direct reference theory are very similar with regard to the mechanism of reference. Barwise and Perry's conviction that meaning is in the world leads them to construct set theoretic entities that can function as the interpretations of expressions and represent the informational

structures so important for their metatheory. Their belief in the objective existence of information results in a semantics where the interpretations of expressions are determined (by the meanings of these expressions) quite independently of the actual state of the world.

When the semantics for necessity and possibility in situation semantics that I gave (section 6.2.2) is compared with Almog's remarks on possible world semantics, we find that a proposition (the interpretation of a sentence, a class of abstract situations) is firstly determined, then this proposition is "taken to other possible worlds" (ie. evaluated with respect to other possible states of the world, as specified or encoded by the M_μ , for $\mu \in \underline{m}$). The definition of truth for sentences \underline{S} , $\Box \underline{S}$, and $\Diamond \underline{S}$ with respect to an utterance situation $\underline{d}, \underline{c}$ was:

$$(19) \quad \mathcal{I} \models_{\underline{d}, \underline{c}}^M \underline{S} \text{ iff } (\exists \underline{e}) (\underline{e} \in (M_0 \cap \underline{d}, \underline{c} \models \underline{S}))$$

$$(20) \quad \mathcal{I} \models_{\underline{d}, \underline{c}}^M \Box \underline{S} \text{ iff } (\forall \mu) (\mu \in \underline{m} \ \& \ M_0 R M_\mu \rightarrow \mathcal{I} \models_{\underline{d}, \underline{c}}^{M_\mu} \underline{S})$$

$$(21) \quad \mathcal{I} \models_{\underline{d}, \underline{c}}^M \Diamond \underline{S} \text{ iff } (\exists \mu) (\mu \in \underline{m} \ \& \ M_0 R M_\mu \ \& \ \mathcal{I} \models_{\underline{d}, \underline{c}}^{M_\mu} \underline{S})$$

Inspecting these definitions we see that it is the interpretation $\underline{d}, \underline{c} \models \underline{S}$ that is crucial to determining the truth or falsity of $\Box \underline{S}$ and $\Diamond \underline{S}$ at $\underline{d}, \underline{c}$; and $\underline{d}, \underline{c} \models \underline{S}$, or at least the minimum situation of that class, is determined solely by the individuals, properties and locations picked out by the expressions and connections \underline{c} . There is no semantic role for the M_μ in determining the proposition -- M_μ has a role only in determining the truth or falsity of the utterance. This is not surprising, since in situation semantics we have all the pieces of the world we need to construct singular propositions.

6.3.2 On the nature of propositions

Almog gives the name 'Objectified Structuralism' to his view of the nature of propositions, for propositions have structure and are

objective, in the sense that they contain actual objects as constituents. Propositions are structured in two ways:

- (i) They reflect the syntactic structure of the sentences that express them.
- (ii) They reflect the nature of the objects referred to by the constituent phrases of the sentences.

On Almog's conception propositions reflect the syntactic structure of the sentences that express them, because each atomic constituent of an object language sentence refers directly to some constituent of the proposition expressed, whether it be an individual object, a property, or something else; the proposition expressed by the whole utterance is constituted out of these pieces. Expressions other than terms and predicates can refer directly; Almog says:²⁴

I believe that other locutions, not discussed here, are also directly referential. For instance, I believe that both the modal sentential adverbs ["Necessarily"] and the classical logical connectives ["and", "or", "not", etc] are directly referential. They can be represented in a purely Russellian ontology by using special kinds of propositional functions. (Almog, 1983, p. 67, footnote)

Unfortunately, Almog does not spell out how he is going to do all this, but hopes to present this material in a later version.

We are reminded of Robin Cooper's semantics by the idea that logical connectives like &, v and - operate on propositions to give other propositions. In the atomic case Almog's propositions look very like Barwise and Perry's situations and Cooper's facts: for Almog an utterance of 'Bagheera is a panther' expresses the proposition containing Bagheera and the natural kind pantherhood. These are the constituents of the proposition, but the proposition is more than the set of these two entities: there is some application of the natural kind to the individual. Russell realised as much when he spoke of some ultimate notion of assertion. Almog tells us that these two entities, Bagheera and the natural kind pantherhood, are the constituents of the proposition than Bagheera is a panther,²⁵ but he does not show us how he represents propositions. There are

essentially only two possibilities: either he constructs propositions out of these constituents, in which case he has to represent the proposition in some manner. We might as well choose the form $\langle \text{pantherhood}, \text{Bagheera}, 1 \rangle$, or perhaps $\langle \text{pantherhood}, \text{Bagheera} \rangle$, at which point the parallelism with situation semantics becomes obvious. Almog's structured propositions look very like Barwise and Perry's abstract situations. Alternatively, propositions may be regarded as primitive, and one of the constituents is absorbed by the ultimate notion of assertion to give a propositional function. This second possibility is not really what Almog wants, for he regards Bagheera and the natural kind pantherhood as constituents; to think of pantherhood as a propositional function which maps Bagheera to the proposition that Bagheera is a panther regresses on the direct reference tenet that 'panther' refers directly to a kind, a property.

The molecular case seems to be different. Whereas Cooper constructs compound facts $\langle \text{and}, f, g, 1 \rangle$ by putting the constituents together in a structure, Almog seems to prefer the alternative representation for molecular propositions. The logical connectives, for example, refer directly to propositional functions, which map the contained subsentences (or the propositions they express -- see note 26 below) to the proposition expressed by the entire sentence. Almog could follow Kaplan (1975) and represent propositions as possible worlds, since Kaplan's work has greatly inspired him; but his dislike of the possible worlds framework would council against this representation.

Almog's view is that the meaning of a sentence determines the proposition expressed as soon as the context is fixed, which is identical to Barwise and Perry's view. For Almog all atomic expressions refer directly to some propositional constituent, so that the entire proposition is determined at the context. As we saw above in relating the direct reference and Fregean views of propositions, the view that referents are referred to directly and determined at the context means that there must be some part of the world that can be the referent and which is a constituent of propositions: the referent cannot be something else that determines a part of the world

when we reach the point of evaluation. This feature of direct reference theory makes it a close relative of situation semantics.

Point (ii) about the structure of propositions reminds us of the discussion of Russell and situation semantics: Almog's propositions contain parts of the world as constituents, objects and properties. Almog conveniently states his ontology in the following passage:

We take objects and properties as basic. They are the propositional constituents of singular propositions. The mechanism of reference correlates a sentence with the proposition it happens to express with respect to: [i] A given historical chain of uses of the expressions in the sentence, and [ii] A given context of use. Thus we operate with: Sentences, causal chains which assign reference rules to expressions, reference-rules, contexts to which those rules apply, and finally, the propositions which are the output of those applications. (Almog, 1983, p. 60)

Much of this apparatus is used to determine the proposition expressed, and would thus be consigned to pragmatics on the narrow view of semantics. What remains are objects, properties, and propositions.

6.3.3 The representational status of singular propositions

According to Kaplan's definition in the preface to 'Demonstratives' (p. 1), a singular proposition is a proposition expressed by a sentence that contains at least one directly referential term. Thus, a singular proposition is just a proposition which contains parts of the real world among its constituents. Originally, these parts were restricted to individuals designated by singular terms, but Almog has since expanded what the parts can be to include properties designated by atomic predicates, thus making the theory very like situation semantics.

The following question arises for any theory that admits singular propositions: if propositions are representations of

possible states of the world, or parts thereof, how can propositions be singular? If the proposition that Socrates is mortal contains Socrates himself, how can part of it represent Socrates?

Our initial response is to say that the proposition can be both representational and singular -- singular because it has constituents that are parts of the world; and representational because these constituents are held together by some operation or structure that is not in the world (thus the proposition as a whole is not in the world). This operation may be modelled by the concatenation of expressions in a language (as Richards does), or by sets generated from urelements (as Barwise and Perry do). Richards takes only individuals as pieces of the world, Barwise and Perry additionally regard properties and locations, which they use to construct propositions (abstract situations), as in the world. Cooper's extension of the theory increases the furniture of the world slightly by adding relations designated by the logical constants.

I have argued that the set theoretical glue of situation semantics must be assimilated to the linguistic case. When the various elements of a proposition are bound together within the proposition, the result is a structure that typically represents a possible, if not actual, state of the world. That some -- indeed all -- of these elements, when considered in isolation, are parts of the world itself does not prevent this. We noted above, especially when we defined the semantics for the abstract level of situation semantics considered as a language (5.2), a tension between Jackie, for example, as physical object and as an expression of the languages we were defining. If there are singular propositions, then constituents of it which are pieces of the world seem to change status when fully integrated into the proposition. If the nature of the proposition is unclear, as it was for Russell, then, at least in the case of the verb, something gets lost between considering a piece of the proposition, firstly, in place in the proposition and, secondly, by itself. On the other hand, if the proposition is explicitly linguistic, as with Richards, we can see more clearly what is going on with all the constituents. The contrast is between an

entity as part of the world and as an expression in a language. Physical objects qua individual constants, ie. when integrated into propositions, require to be given a meaning (in the model-theoretic sense), and hence have a representational role -- even if they represent themselves.

Almog's proposed semantics is no different from the others in the case where an atomic sentence designates an atomic proposition. His terms contribute individuals, atomic predicates contribute properties, and other predicates contribute logical complexes; all these pieces have to be combined, and the situation is the same.

The molecular case is slightly different. Cooper represents a molecular proposition in the form $\langle \text{and}, \underline{f}, \underline{g}, 1 \rangle$, introducing another primitive, 'and', and uses the set theory to construct the molecular proposition from its constituents, ie. the new primitive relation designated by 'and', two propositions \underline{f} and \underline{g} , and a truth value. My point about aggregates of entities -- there must be a non-world element somewhere -- applies equally to this approach as to the atomic case. Indeed, Cooper's representation of molecular propositions (molecular facts) assimilates this case to that of atomic propositions: in both a relation holds or does not hold among several entities.

Almog could do something different at the molecular level, though it is not entirely clear, for he does not present his analysis. His remark that, for example, the conjunction operator would directly refer to a propositional function implies that in his system we obtain the new proposition directly: the new proposition is $\rho(\underline{f}, \underline{g})$, where ρ is the propositional function and maps the propositions \underline{f} and \underline{g} to the new proposition.²⁶ By emphasising propositional functions, Almog models his semantics at the molecular level on Russell and Kaplan, not the Barwise, Perry, and Cooper approach: the latter construct propositions set theoretically from various pieces; the former isolate only some constituents and treat the remainder of the proposition as a function from these constituents to the proposition.

6.4 Conclusion

In this chapter we compared situation semantics with direct reference theory. To make the comparison as illuminating and useful as possible, we employed the technique of Kaplan (1975): to formulate the 'ontology' (in the sense in which Kaplan uses this term) of each theory, and then to investigate ways of reducing or reformulating the ontology of one theory to bring it into line with that of the other. To increase the scope of the analysis, I provided a semantics of necessity and possibility within the situational framework.

At the abstract level, situation semantics and direct reference theory have much in common, and the more so with Almog's development of the direct reference view. The family resemblances between situation semantics and direct reference theory consist in the inclusion of real world entities in propositions and the view that propositions are structured entities. Differences exist too: the proposition, as a class of abstract situations, is the semantic value of an utterance in situation semantics, whereas Almog could still maintain that utterances, although expressing propositions, designate truth values. Moreover, whereas Barwise and Perry claim that their theory places meaning in the world (a claim which we seriously question) Almog is free to declare his affiliation to the view of meaning as language-dependent.

Chapter Seven: The Attitudes

7.1 Attitude reports: introductory

Throughout this thesis we have been examining some aspects of situation semantics to discover what the theory is and as a preparation for investigating what new insights the theory can offer us regarding the traditional puzzles of the attitudes. It is now time to focus more explicitly on the attitudes themselves, that is, on the semantics of sentences which report attitudes and the semantic behaviour of expressions in what are known as propositional attitudinal contexts.¹ Attitude reports are utterances of sentences containing attitude verbs, like 'believes', 'knows', 'doubts', and 'sees that'. The following are typical attitude reports:

- (1) John believes that Venus is closer to the sun than the earth is.
- (2) John knows that Margaret Thatcher became Prime Minister in 1979.
- (3) Ralph doubts that the man seen on the beach is a spy.

I shall ask how situation semantics affects our understanding of the attitudes, whether it provides us with new tools for their analysis, and, if so, what further illumination we now have (this we shall do in the next chapter). First, however, I want to discuss the semantics of propositional attitude contexts in fairly general terms and to formulate the issues as they affect us in the present work.

7.1.1 The failure of substitution of coreferential terms

A major problem that the attitudes pose for semantic theory is that they (apparently) violate Leibniz' Law² -- what we would normally regard on an innocent view as coreferential expressions are not substitutable salva veritate in propositional attitudinal

contexts, at least that is our intuitive judgement. For example, when both (4) and (5) below are understood as referring to a period of time before Oedipus discovers the truth, we are straightforwardly inclined to think (4) is true, but (5) is false.

(4) Oedipus believed that he married Jocasta.

(5) Oedipus believed that he married his mother.

This observation is extremely serious, for Leibniz' Law expresses a fundamental principle of referential semantics.

The basic problem with belief attributions was given classical expression by Quine (1956); since then an enormous amount of energy and thought has been devoted to a solution, so far without success. Quine called propositional attitude contexts '(referentially) opaque', to contrast them with transparent, extensional contexts. It is possible to regard this term merely as a label for the problematic phenomenon; however, to call the problem by its full name, referential opacity, already suggests that the phenomenon is being viewed from a non-innocent perspective. For the references of expressions, the idea is, are no longer their ordinary references, the references that they have in transparent contexts.

The problem is often thought of in terms of the traditional distinction between de re and de dicto readings of singular terms.³ When the sentence is given the de dicto reading, coreferential singular terms are generally held not to be intersubstitutable in attitude contexts; on the de re reading, they are generally held to be intersubstitutable (but see the section below on Burge, who disagrees). Our objection to

(6) Ralph believes that Ortcutt is a spy.

as suitable for reporting Ralph's belief in Quine's story requires us to give it the de dicto reading -- there is no problem with the truth of (6) on the de re reading. The thought here is that a de re attitude report involves the individual object itself, not the object under a description, and thus the report remains true when another

coreferential singular term is substituted in the embedded sentence, the attitude report remaining de re. The de dicto attitude report, on the contrary, does not involve the "bare" object. The de dicto reading presents the object under a particular description, while the de re reading does not.

This matter should become clearer when we consider some proposals for the logical form of de re and de dicto cases of belief. Quine represents the two senses of belief, the de dicto (notional) and de re (relational) senses respectively, as:

(7) Ralph believes that Ortcutt is a spy.

(8) Ralph believes z(z is a spy) of Ortcutt.

(Quine, 1956, p. 104) The analysis of de re belief is in terms of a relation between Ralph, a property or attribute and an individual (Ortcutt). In the de dicto case, the individual is absorbed into the attitude to give a proposition. Opacity is restricted to 'that Ortcutt is a spy' in (7) and 'z(z is a spy)' in (8). Hence, Ortcutt occurs in a referentially opaque context in (7), where it is not eligible for substitution, but in a transparent context in (8), where it is. There seems to be a correlation between the de re/de dicto distinction and the success or failure of substitution.

Brian Loar (1972) adopts an approach which is similar to Quine's representation of the relational or de re sense of belief and uses this representation as the basis for an explanation of both readings. Loar's point is that singular terms can make an additional contribution beyond their referent. To believe something of an individual under a certain description is to have a conjunctive belief with regard to the individual. Beliefs are represented as a relation between the agent, an open sentence, and an individual (or sequence of individuals). What is interesting about Loar's proposal is that even de dicto belief involves the object itself: the difference in the two forms of belief is not in how the object enters into the belief (or whether it does), but in what is believed of it. In Loar's notation, we may represent beliefs Ralph might hold as follows:

- (9) a. B(Ralph, "x is a spy", the man in a brown hat)
b. B(Ralph, "x is a spy", Orcutt)
(10) B(Ralph, "x is the man in the brown hat & x is a spy",
Orcutt)

Loar's belief relation is extensional; Orcutt himself occurs in the third place in all three formulae, so this analysis makes (9a) and (9b), both instances of de re belief, equivalent. The de dicto belief is set apart from these because the open sentence it involves is quite different.

Tyler Burge takes issue with the view that the de re/de dicto distinction is marked by the substitutivity, or failure thereof, of coreferential singular terms, at least when the criterion of substitution is applied to surface structures (Burge, 1977). Burge claims, convincingly, that substitution fails in some cases which are nonetheless instances of de re belief. An example Burge provides is that of a man seen at a distance in a swirling fog; surely, he says, any beliefs that we subsequently hold about the man based on this encounter are de re.

Consequently, Burge is drawn to characterise de re/de dicto distinction in terms of the extent to which the belief is conceptualised: a belief is de re if the agent cannot describe the object of his belief so as to individuate it fully, that is, if he cannot describe it without recourse to indexical reference.

A de re belief is a belief whose correct ascription places the believer in an appropriate nonconceptual, contextual relation to objects the belief is about.
(Burge, 1977, p. 346)

A belief is de dicto if the agent can individuate the object of his belief in purely descriptive terms. Burge summarises his view:

More generally, purely de dicto attributions make reference to complete propositions -- entities whose truth or falsity is determined without being relative to an application or interpretation in a particular context. De re locutions are about predication broadly conceived. They describe a relation between open sentences (or what

they express) and objects. (Burge, 1977, p. 343)

Such a view of the two kinds of attitude report partly explains why coreferential terms are generally intersubstitutable in de re reports, but not intersubstitutable in de dicto reports.

These writers treat the difference between de re and de dicto belief as follows. Quine's analysis allows us to separate Ortcutt, the individual, from the remainder of the proposition with cases of de re belief, so that occurrences of a singular term designating the individual are extensional and hence available for substitution. Loar's analysis allows the singular term designating the individual not only to determine the individual, but also to contribute to what is predicated of him. Finally, Burge analyses the distinction in terms of the manner in which the agent individuates the object. In different ways these writers have tackled the question of wherein lies the difference between the two kinds of belief.

7.1.2 Cognition and the failure of substitution

Where attitude reports are understood in terms of the agent's having an attitude towards something (typically a proposition, however this is understood exactly), there is always the tendency or temptation to explain the referential opacity of singular terms in attitudinal contexts as involving the agent's perspective on the state of affairs to which he is related. It seems that the agent's perspective, in some circumstances at least, is the crucial factor that influences our intuitive judgement of truth conditions. Thus, if, from a distance, Ralph sees a man in a brown hat acting suspiciously and comes to believe that the man is a spy without recognising the individual, who is in fact Ortcutt, and if we know all this, then we would normally assent to an utterance of

(11) Ralph believes the man in a brown hat is a spy.

but object to an utterance of

(12) Ralph believes Ortcutt is a spy.

on the basis that Ralph either does not know Ortcutt or does not recognise him.

However, our judgement of the truth or falsity of (12) is notoriously sensitive to context. If the addressee does not know Ortcutt, our judgement is likely to be that the utterance is false; if the addressee does know Ortcutt, we are more likely to allow that the utterance is true. In this last case Ralph is thinking of Ortcutt, although not as Ortcutt, when he thinks of him as a spy.

At least part of the explanation for this state of affairs seems to be as follows. The speaker has several ways of referring to Ortcutt: as Ortcutt, as the man in the brown hat, as the man seen at the beach, etc. What makes him choose one particular referring expression rather than another? Something like Grice's maxim of cooperation⁴ is probably operating. There are numerous possibilities regarding how the addressee is situated with respect to the various referring expressions that the speaker could use: whether or not he knows Ortcutt; whether or not he knows that Ortcutt is the man in the brown hat; whether or not he knows that Ortcutt is the man at the beach; etc. If the addressee does not know Ortcutt under any of these descriptions, he will not come to know of whom Ralph has a belief simply by hearing the embedded sentence 'Ortcutt is a spy', and this will be true irrespective of which referring expression is used. The information which the addressee is able to extract from the utterance partially governs the speaker's choice of referring expression. When each referring expression carries the same information for the addressee, the speaker is free to choose that expression which best captures how Ralph thinks of Ortcutt; hence under these circumstances the speaker would normally be expected to utter (11). If, therefore, the utterance is an utterance of (12), we suppose that the speaker is claiming that Ralph's belief is of Ortcutt as Ortcutt, and this claim we know is false.

Consider another case of how the addressee is situated, this time where the addressee knows Ortcutt, as mayor and as the man at the beach, but is unaware of his espionage activities. The speaker, to be cooperative (that is, to communicate fully the intended information), must use either 'Ortcutt', 'the mayor' or 'the man at the beach' or an expression which identifies Ortcutt in his role as a public figure in referring to Ortcutt. The constraint to be cooperative with the addressee overrides the constraint to be accurate about how Ralph thinks of Ortcutt.⁵

At the beginning of his analysis Quine draws the distinction between the relational and the notional senses of belief in non-cognitive terms. With respect to

(13) $(\exists x)(\text{Ralph believes that } x \text{ is a spy})$

(14) $\text{Ralph believes that } (\exists x)(x \text{ is a spy})$

he says: 'The difference is vast; indeed, if Ralph is like most of us, [14] is true and [13] is false.' (p. 102) When he reluctantly brings intensions into the picture later, they are intended as more refined tools with which to get a firmer grasp on the meaning or reference of the embedded sentence. There is nothing particularly agent-relative about his approach, nor does he attempt to use intensions, or a refinement of them, to capture the agent's perspective on the state of affairs he is related to.

Other writers appeal explicitly to cognitive and conceptual factors. While I clearly cannot deal with all the proposals by those who believe the agent's perspective has a role in the semantics of attitudinal contexts, I do want to mention Hartry Field's conceptual role semantics,⁶ Colin McGinn's dual structure approach to content,⁷ and the explicitly epistemological character of Esa Saarinen's semantics for the attitudes.⁸ These writers incline to the view that we should include a cognitive component in meaning in order to explain the phenomena associated with referential opacity.

The roots of this strategy go back to Frege. His notion of sense was introduced to explain the difference in informativeness of

such sentences as 'Hesperus is Hesperus' and 'Hesperus is Phosphorus'. Since the references of these proper names are identical, a theory of meaning that notices only the external significance of expressions fails to account for the discrepancy between the informativeness of the second sentence and the uninformativeness of the first. Sense, operating as a mode of presentation, has become (for some people) permeated by cognitive notions and factors. The notion of sense has been put under enormous strain in being called upon to perform a number of widely differing tasks, ranging from determining the referent (concerned with external meaning), through being what it is that the speaker knows when he understands an expression, to capturing the mode of presentation (concerned with "cognitive meaning").

Not everyone, however, shares this view of the notion of sense; indeed dissenters from the view are found even within the Fregean camp. Gareth Evans and John McDowell have a rather different conception of sense, one which is highly critical of loading sense with cognitive factors. John McDowell has made some very apposite remarks on this issue of the role of cognition in both meaning and the theory of meaning. In McDowell (1977) he begins by asking what we want the notion of sense for; his answer is that the task of a theory of sense, within a total theory of language, is to fix the content of speech acts. People produce linguistic behaviour, which we are interested in understanding. This understanding is essentially an interpretation for the speech act or utterance event, described originally as 'He made the noises ...', is redescribed in terms of what the speaker said. The role of the notion of sense, therefore, is to help us interpret people's linguistic actions.⁹

To find a means of specifying the content of utterances, McDowell adopts a Tarskian truth theory. As the title of his article suggests, McDowell is concerned primarily, but not exclusively, with proper names. A Tarskian truth theory will contain axioms and entail theorems like the following:

- (15) 'Hesperus' denotes Hesperus.

- (16) 'Hesperus is visible' is true iff Hesperus is visible.

The critical point for McDowell's conception of sense is that the predicate whose application to object language sentences is governed by the theorems that the theory entails can be written 'is true' (as in (16)), because the used sentences (those on the right hand side) specify the content of potential utterances. It is this fact that means that the truth theory can serve as a theory of sense, not the fact the theory is a truth theory.

The "austere" conception of sense, as McDowell calls his view, takes one formulation of a Tarskian truth theory, which gives the references of expressions in a language, and makes it serve as a theory of sense. Thus (15), but not

- (17) 'Hesperus' denotes Phosphorus.

is suitable to serve as part of a theory of sense. We can discriminate between (15) and (17), which are equally valid expressions from the point of view of the theory of reference, because we are using the theory to fix the content of utterances and to understand speakers.¹⁰

Gareth Evans also espouses this conception of sense, applying it to the theory of demonstratives (Evans, 1981) and a variety of singular terms (Evans, 1982). Succinctly stated, the idea is:

Although a theory of meaning for a language must give the senses of expressions, we are not to think of the theory of sense as a separate tier, additional to and independent of the theory of reference. If sense is a way of thinking of reference, we should not expect to be given the sense of an expression save in the course of being given the reference of that expression. Rather than look for a theory quite independent of the theory of reference, we must take one formulation of the theory of reference -- the formulation of the theory which identifies the references of expressions in the way in which one must identify them in order to understand the language -- and make it serve as a theory of sense. (Evans, 1981, p. 282)

Having said what the Evans-McDowell conception of sense is, we are in a position to think through its rejection of the view that

cognition has a place in the explanation of opacity. The view of sense in question emerges from the Quinean perspective of the radical translator attempting to interpret the presumed utterances of "natives". Because of this, and because the notion of sense is designed to help us to make sense of speakers through fixing the content of utterances, it is essentially descriptive of the empirical situation. McDowell remarks:

We can picture the failures of substitution and the differences in sense as, jointly and inseparably, products of our attempts at principled imposition of descriptions in terms of speech-acts, and explanations in terms of propositional attitudes, on to the hard behavioural facts about linguistic and other behaviour, with the point of the imposition being to see how sense can be made of speakers by way of sense being made of their speech. In this picture, the differences in sense are located no deeper than the failures of substitution. (McDowell, 1977, p. 157)

Yet the Evans-McDowell conception of sense has not abandoned (close) contact with the agent's cognition. Both Evans and McDowell would argue that it is still Frege's notion of sense they are working with (rather than, says, Church's or Dummett's interpretations of Frege), and that sense is bound up with understanding, as Frege held.¹¹

McDowell's concept of what sense is, worked out against the background of what sense is for, leads him to see it not as explanatory of the failure of the substitution of coreferential expressions, but as a description of that failure. The phenomenon of referential opacity, therefore, remains unexplained by the notion of sense.

We have been asking the question, Does cognition have anything to do with opacity? Where is the problem of referential opacity fundamentally located? We have seen, admittedly briefly, that one answer is to view opacity as stemming from the involvement of the agent's cognition in his attitude in a way that influences our judgements on the truth or falsity of utterances reporting that attitude. On this view, semantics can only handle opacity by

allowing some semantic role for a component of meaning intended to capture the relevant features of the agent's cognition. Those who advocate this approach would claim that the resultant semantics captures the relevant inferences.¹² McDowell cautions us against this approach, arguing that the notion of Fregean sense, while it has independent justification, is not justified merely by the hope that it will be able to explain the failure of substitutivity in propositional attitude contexts. An alternative motivation for the notion shows clearly that differences in sense are descriptive of the failure of substitutivity.

Does the agent's cognition have a major role to play in the semantics of the attitudes? The question here is the correct analysis of attitude reports: how should they be understood? This is the context in which we should see Barwise and Perry's contribution to the field, for they want to use the concept of information to solve the attitude puzzles. Information, enabling one hopefully to make the necessary distinctions without appeal to the agent's perspective, concepts or mental representations, will constitute the basis for an innocent semantics.

7.2 Innocent semantics and the attitudes

Barwise and Perry have espoused innocent semantics and claimed that they can give an innocent semantics of the attitudes. Now, clearly, there is no possibility in innocent semantics of adding to meaning a component that is supposed to capture the agent's perspective on an object or state of affairs. Instead, Barwise and Perry have declared their conviction that the puzzles with attitude reports do not require us to invoke the agent's perspective, their adopted strategy for the attitudes being expressed by the principle of the Priority of External Significance:

The mental significance of language, including the role of sentences embedded in attitude reports, is adequately explained by their external significance, properly

understood. (S&A, p. 42)

The semantics for the attitudes that they settle upon in the end involves the notions of indirect classification, which they define informally as 'the exploitation of patterns and constraints to classify one situation with another', (S&A, p. 225) and of cross-classification. The situation described by the embedded sentence of an attitude report is intended to classify the agent's cognitive situation by exploiting constraints of folk psychology. The verb 'to classify' was first used of the relation borne by an abstract situation to a real situation (though without a clear statement of what it was supposed to mean). Here Barwise and Perry mean a relation between two abstract situations: the embedded sentence designates one abstract situation, which bears some relation to another abstract situation, the precise relation being determined by the attitude involved.

We are describing the agent's beliefs by comparing the external significance of those beliefs with the external significance of the embedded sentence in our attitude report. (S&A, p. 258)

This, in outline, is the strategy Barwise and Perry hope will deliver an innocent semantics of the attitudes.

7.2.1 Is innocence forced to compromise?

The exposition of the semantics of the attitudes in Situations and Attitudes bears marks of the historical development of the material. We are presented in chapter nine with an account in terms of the agent bearing relations to various courses of events; thus: 'Attitude reports involving the phrases KNOWS THAT and BELIEVES THAT report on an agent's relations to various courses of events, relations determined by her state of mind at the time. They do not refer directly to these states of mind.' (p. 213) These relations are denoted SO, BO, KO, etc. Another approach is developed in chapter ten because of difficulties encountered in the first

approach. The view which understands attitudes as relations to abstract situations cannot provide a full and satisfactory explanation of the attitudes, for the agent's cognitive situation has to be taken explicitly into account when one faces up to the problems of the attitudes.

Chapter ten of Situations and Attitudes consequently divides into two main sections; the first sets out how to represent the mental, and makes use of "concepts" to represent beliefs and other attitudes. A concept is an ordered pair of an indeterminate and an event type, or schema, thus: $\langle o, \underline{S}(o, \dots) \rangle$; it is used in the theory to model or represent the way the agent thinks of objects or states of affairs. Schemata specify relations holding between the object and other individuals, and thus represent the way agents think of the object. For example, suppose John believes that Susan is prettier than Mary, and suppose Mary is his sister. John's belief may be represented as in either e_1 or e_2 :

$e_1 :=$ at \underline{l} : \underline{B}_x , John, \underline{S}_1 ; yes

of, a, Susan; yes

of, b, Mary; yes

$e_2 :=$ at \underline{l} : \underline{B}_x , John, \underline{S}_2 ; yes

of, a, Susan; yes

where

$\underline{S}_1 :=$ at \underline{h} : prettier-than, a, b; yes

$\underline{S}_2 :=$ at \underline{h} : prettier-than, a, b; yes

sister-of, b, i; yes

By this stage we have surely begun to question whether Barwise and Perry are still doing innocent semantics.

It is claimed that schemata must be introduced in order to capture various uniformities and constraints. We are offered such examples as 'A mother who believes that her baby is hungry will feed it'. The motivation is that one must be able to abstract away from

individual cases of a particular mother (eg. Lynn) believing her baby (Erin) is hungry and being disposed to feed it, to capture the generality of the observation; we also need to capture the mother's perspective -- Lynn will only feed Erin when she thinks of him as her baby, not if she comes across him in unfamiliar circumstances and does not recognise him. And such abstraction leaves us with indexed situation types (ie. situation types containing the roles i and h, which are distinguished in that they are always anchored to the agent and the location of the belief respectively).

Concepts give Barwise and Perry a finer network of relations with which to describe what is going on, than the mere objects and relations that there are in the world: pure external significance simply does not cut reality fine enough for the semantics of the attitudes. Of course, Barwise and Perry anchor schemata, but nothing would be gained by introducing this finer mesh of relations and immediately replacing it with anchored schemata, which are just abstract situations (provided all the indeterminates are anchored), for that is to return to the grosser network of extensional objects and relations. In fact, in Barwise and Perry's semantics, the object of the attitude is the unanchored schema and the relation that holds between the agent and the object of the attitude is the represented relation X_I .¹³ The attitudes are no longer viewed as relations to (abstract) situations, but to schemata: anchoring only happens after the agent has been related to the schema.

Consider the sentence 'John believes that Cicero denounced Catiline'. The schema here is a singleton \underline{S} , whose member is the event type \underline{E} :

$\underline{E} :=$ at \underline{l} : denounces, \underline{a} , \underline{b} ; yes

The whole sentence describes the situation \underline{e}_0 :

$\underline{e}_0 :=$ at \underline{l} : \underline{B}_I , John, \underline{S} ; yes

of, \underline{a} , Cicero; yes

of, \underline{b} , Catiline; yes

of, l , l' ; yes

where $l = c(\text{believes})$, $l \circ l_d$, and $l' < l_d$. Now abstract situations, as distinct from event types, are constructed from individuals, relations, locations and truth values, but here we find the schema S as a constituent of e_0 . Does this mean that schemata and event types, as well as being abstract objects that have a classificatory role in the semantics, are also actual objects in the world, to which agents can bear real world relations (eg. B_r)? On the other hand, supposing S , E , and B_r to be purely abstract theoretical entities, what is the entity $e_0 = \{ \langle l, \langle B_r, a, S \rangle, 1 \rangle \}$, if not an abstract situation?

I think Barwise and Perry are themselves confused about some of the abstract entities in their semantics. The use of concepts in situation semantics, talk about indirect and cross-classification notwithstanding, is just a reintroduction of modes of presentation, of ways of thinking of an object, of capturing the agent's or someone else's perspective on an object or state of affairs.

Barwise and Perry peddle a subtle blend of innocent and non-innocent theorising in chapter ten of their book. The shift to talking of cognitive states ("cognitive situations") is motivated by the failure of the theory in chapter nine, namely viewing attitudes as relations to abstract situations. These relations, whose relata include proper classes, are not part of the causal order and must be supported by something else, so Barwise and Perry turn their attention to agents' cognitive states.

Even then, the informal explication of the theory sometimes retains its innocence. For example, Barwise and Perry say:

How can we describe minds by referring to situations that aren't mental, situations external to minds and brains, and those that may not even be real? (S&A, p. 225)

The view is that, with reference to

(18) Penelope fears that Odysseus will never return home.

we are actually and definitely referring to Odysseus, not Penelope's

concept of Odysseus or a public concept of Odysseus, and it is this detail that Barwise and Perry point to when the innocence of their theory is challenged. The actual formal theory, on the contrary, does not involve Odysseus: the interpretation of an utterance of (18) relates Penelope to the schema containing the situation type

$E :=$ at l : returning-home, a ; yes.

In the interpretation the indeterminate a will be anchored to Odysseus and the indeterminate l to a location \underline{l} , where $\underline{l}_d < \underline{l}$. The reference of the embedded sentence in the utterance is not a situation external to minds, not even one that is unreal: the reference is the schema and innocence has been abandoned.

One problem with relating Penelope to a situation containing Odysseus is that we do not want utterances of

(19) Penelope fears that the beggar in the palace will never return home.

where the description 'the beggar in the palace' is used referentially to refer to Odysseus, to come out true. Since the description is used referentially, the situation contains only the referent -- Odysseus himself -- and the interpretation of (19) would be indistinguishable from that of (18).

Although concepts are given a role in the semantics, Barwise and Perry still claim to be working at the level of external significance. If this were so, however, then where \underline{S}_1 and \underline{S}_2 are schemata and \underline{f}_1 and \underline{f}_2 total anchors such that $\underline{S}_1[\underline{f}_1] = \underline{S}_2[\underline{f}_2]$, (ie. the external significance of these schemata when thus anchored is the same), how could a semantics grounded upon external significance make differential use of \underline{S}_1 and \underline{S}_2 ? Do schemata therefore have an irreducible semantic role?

Consider the semantics for belief:

$d, c \models [\text{believes that } \varphi] \text{ } \langle a, e_0 \rangle$

iff

$\exists \underline{S}, \underline{f}$ such that (i) $\langle \underline{S}, \underline{f} \rangle$ is a way of believing $\underline{d}, \underline{c} \llbracket \underline{\phi} \rrbracket$ for \underline{a} at $\underline{l} = \underline{c}(\text{believes})$, ie. $\underline{a}, \underline{l}, \underline{f} \llbracket \underline{S} \rrbracket \underline{e} \rightarrow \underline{d}, \underline{c} \llbracket \underline{\phi} \rrbracket \underline{e}$.

(ii) in \underline{e}_0 : at \underline{l} : \underline{B}_x , \underline{a} , \underline{S} ; yes

of, \underline{x} , $\underline{f}(\underline{x})$; yes.

(S&A, p256) What is the status of the relation \underline{B}_x ? Barwise and Perry say of the parallel relation \underline{S}_x for perception:

Thus the relation \underline{S}_x is one the observer brings to the situation when she characterises the agent \underline{a} as having a certain type of perception. (S&A, p. 234)

According to Barwise and Perry, when someone utters

(20) Susan believes that John loves Mary.

they are classifying Susan as being related to a state of affairs in a certain way; Susan could also be described, let us suppose, as related to the same state of affairs by

(21) Susan believes that John loves her sister.

There is a difference between (20) and (21) that semantic theory must capture.

Innocent semantics, however, eschewing such entities as modes of presentation, is committed to operating with the external significance of expressions. In an attempt to alleviate our fears that they are giving up innocence, Barwise and Perry talk of the importance of indirect classification, cross-classification, and the fallacy of misplaced information in propositional attitudinal contexts. Does the deployment of these concepts salvage innocence?

Among the criteria for a semantic theory proposed in the second chapter of Situations and Attitudes are the following two: the theory must account for the external significance of language; and it must account for the mental significance of language. Unlike Frege, who bifurcated the notion of meaning into sense and reference, Barwise and Perry, influenced by the Gibsonian, or ecological, metatheory they espouse, believe that one level of meaning (the interpretation) can be used for both these tasks. They want to have the actual

individuals, properties and locations of real situations there in their semantics, grouped into structures and related by the linguistic meaning of expressions, so that they get the state of the world right; and they want in addition to capture cognitive significance with these same structures. Their conviction that this is possible is supported by a doctrine of ecological psychology, the duality of organism and environment.¹⁴

The basic idea is to use indexed event types to classify both what is seen and how it is seen. The indeterminates in the indexed event-type will be anchored to an agent, a location, and objects and relations through facts about the perceptual event. The event-type and the indeterminates in it will represent a perception suited to carry information about the type of event that is seen. The event-types get at two different kinds of uniformities, across mental events and across scenes. The possibility of using event-types in this dual way is a result of the duality discussed above. (S&A, p. 233)

One is struck by the explicit statement that it is indexed event types that constitute the level that is supposed to capture both the uniformities, both kinds of significance. Indexed event types are not interpretations of any expression; in particular, they are not the references of embedded sentences in attitude reports.

The classificatory behaviour in common sense psychology and thought to which Barwise and Perry have drawn our attention is a part of human linguistic behaviour, and as such is a part of the world. How can an innocent semantics handle this? The problem that has arisen for innocent situation semantics, operating with Barwise and Perry's distinction between the world and the theorist's classificatory apparatus for describing and representing the world, is that part of what is in the world is itself a classification of parts of the world.

If these notions of indirect and cross-classification are not rebuilding modes of presentation into situation semantics, what are they doing? Indirect classification is the classifying of an agent's beliefs by comparing the external significance of those beliefs with the external significance of a sentence (the embedded sentence of a

report) at an utterance situation. Cross-classification seems to have a more subtle role in the semantics, having to do with capturing other uniformities than those that are supposed to have given rise to the ontology of individuals, properties and locations in the first place. Can an innocent semantics employ that ontology, and still talk of cross-classification?

7.2.2 Innocent semantics and information

Recourse to cross-classification implies that Barwise and Perry recognise that innocent semantics has to treat the cognitive significance of linguistic communication. The interpretation in situation semantics is under strain from being asked to perform the two tasks of representing external and mental significance. The fallacy of misplaced information is invoked to relieve the interpretation of this burden by using the notion of information to link the semantics with our intuitions and judgements about particular cases. The use of concepts to capture mental significance, and of anchors to tie schemata down to the real world, and thus to external significance, equivocates between these two kinds of significance. Barwise and Perry want to have their cake and eat it: the claim that the semantics is innocent rests upon the fact that when challenged about the schema \underline{S} , one can point to the abstract situation $\underline{S}[\underline{f}]$. But it is the schema \underline{S} , not the abstract situation $\underline{S}[\underline{f}]$, that has the semantic role; moreover, at the level of the abstract situation $\underline{S}[\underline{f}]$ one has lost the ability to make the necessary distinctions in capturing the uniformities involved in attitude reports.

The fallacy of misplaced information is the mistake of thinking that all the information available to a hearer should be contained in the semantic value of the utterance (its interpretation). Barwise and Perry are surely right in regarding this as a fallacy. Their examples, however, are trite: the use of a name 'Cicero' conveys the information that someone is (or was once) called 'Cicero'.¹⁵ As

Barwise and Perry realise, one can ask how an innocent theory is supposed to be sensitive to the referring expression used, when it is only the individual object in question that is relevant to the interpretation.

This objection contains an instance of the fallacy of misplaced information. The change in the report from TULLY to CICERO makes an enormous difference to the information made available by the report, and an innocent theory need not overlook this if it is combined with a relational theory of meaning. Part of the information you can get is the information that someone is called "Cicero", and of course you do not get this information if "Tully" is used instead. This is so even though the interpretation of the report remains the same. (S&A, p. 264)

Of course they are right: one does get different information. The classical case here is that of Hesperus and Phosphorus.

Suppose Harold knows Venus only by the names 'Venus' and 'Hesperus'. Utterances of the two sentences

(22) The astronomers intend to study Hesperus this month.

(23) The astronomers intend to study Phosphorus this month.

will therefore contain very different information for him. If Harold has heard of Phosphorus, but knows only that it is a planet, not realising that Phosphorus is Hesperus, he will come to believe that the astronomers intend to study a planet, without realising that the planet in question is Hesperus. If he has never heard the name 'Phosphorus' before, he will know only that the astronomers intend to study something or other -- perhaps a comet, perhaps he might even think they intend to study the distribution of the element phosphorus in space.

Barwise and Perry have sought to use the notion of information to explain why they use concepts and schemata in their semantics. Their remarks that differential information is available to hearers are uncontroversial, but do not legitimise the use of schemata in interpretations of attitude reports. Having pointed out that differential information which is available from utterances of

sentences that are identical except for occurrences of coreferential terms is not reflected at the level of interpretation and should be sought elsewhere, Barwise and Perry immediately forget and dismiss their own observation by building schemata and anchors into their semantics for the attitudes, thus building sensitivity into their semantics in the wrong way.¹⁶

A truly innocent semantics would require recasting situation semantics as follows. We throw out schemata and anchors, and a new relation Bel will relate the agent to an abstract situation (or alternatively, to a set of abstract situations). We confront the issue of cross-classification by relocating the information involved with this as inverse information, instead of trying to pack it into the interpretation. Thus, an utterance of 'Lynn believes her baby is hungry', describes any situation that contains

$\langle \underline{1}, \text{Bel}, \text{Lynn}, e_1, 1 \rangle$

where

$e_1 := \text{at } \underline{1}: \text{hungry}, a; \text{yes}$

 baby-of, a , Lynn; yes

where $\underline{1} = c(\text{believes})$. In words, Lynn bears the relation Bel to a situation in which an individual which is her (Lynn's) baby is hungry. This is just the strategy Barwise and Perry pursued with names, applied to attitude reports.

Early in the book there is a comment on the relation between information and the interpretation, which is the core semantic concept.

Our theory ... does not provide a third realm, a realm of objects interacting with language, mind, and external world, but rather a classificatory scheme, a system of abstract objects that allow us to describe the meaning both of expressions and of mental states in terms of the information they carry about the external world. (p. 7; emphasis added)

The notion of information is to be given a central role in situation

semantics. Importantly, information here means information in general, and all this information is to have a role in the theory. Barwise and Perry are constantly confused as to whether (what ends up as) inverse information should have a semantic role (thus interpretations will involve schemata) or whether it should not (thus the fallacy of misplaced information will be affirmed). They end up choosing both of these! Notice the difference between the treatment of names, where inverse information is held separate from interpretation, and the semantics of the attitudes, where the issue of cross-classification is confused.

The fallacy of misplaced information does not imply that none of the information available in an utterance is carried by the interpretation. Rather, it is the doctrine that the latter is just a part of the information available, though an especially important and significant part. When someone truthfully utters 'John loves Mary', the utterance makes available the information that someone is called 'John', etc. -- all the inverse information available. It also conveys the information that John loves Mary -- in fact, that is precisely what it says.

The information contained in the interpretation, a part of the total information content of the utterance, has been designated semantic content and elevated to a special status relative to the inverse information. Thus, Barwise understands linguistic meaning within the context of meaning in general, and understands meaning and inference within a comprehensive theory of information.¹⁷ In writing about the multiplicity of things a situation can mean, he says:

A given situation, be it ever so simple, is going to be of more than one type. And each of these types can play a role in one or more constraints. [...] In our book, Perry and I concentrate on what the utterance means about the described situation, because we are primarily interested in the straightforward use of language to convey information. Thus, we identify the linguistic meaning of declarative sentences with the specific constraint that holds between utterances of the sentence and situations described by such utterances. By picking out one constraint, the one that holds between the types of utterances of sentences [3] ['It's 4 p.m.] and the

types of situations it describes, and calling that the linguistic meaning of [3], we are betraying the fact that our primary concern is for the subject matter of the sentence, for finding out what it is talking about and what it is saying about that subject matter. (Barwise, 1983, pp. 24,25)

Barwise realises that semantic content is only a part of the information available, a part of the information singled out to play a special role. In the chapter to follow we consider how well this strategy works, by asking how situation semantics deals with some traditional puzzles posed by the attitudes.

Chapter Eight: Situation Semantics and the Attitude Puzzles

8.0 Introduction

In the analysis of situation semantics in preceding chapters, I have considered three features in particular: (i) partiality in the semantics; (ii) the role of information in the semantics and the consequences for semantic innocence; and (iii) the quasi-linguistic or representational status of the level of abstract semantic entities. In considering the implications of situation semantics for a semantic treatment of the classical problems of the attitudes and asking what illumination the theory sheds, I shall concentrate attention mainly on these aspects.

The treatment falls into three parts. Firstly, I shall formulate some puzzles with attitude reports (section 8.1); secondly, I shall look at partiality and the problem of logical omniscience (section 8.2). Thirdly, I shall consider all the puzzles in turn from the perspective of situation semantics, with particular emphasis on the notion of information and the view that the level of abstract situations is a quasi-linguistic level of representation (section 8.3). Our concern is to investigate whether these may be factors in a solution to the propositional attitude problems. We shall on occasions consider developing or modifying the semantics to extend the ways in which these features might have a place in solving the problems within the framework of situation semantics.

8.1 Some traditional puzzles

The purpose of this section is to lay out and fix a formulation of some of the puzzles that have frustrated traditional theories of the attitudes. The problems may be grouped into three major kinds: the attribution of logical omniscience, substitutivity and referential opacity, and the exportation of quantifiers from attitude

contexts, the second of these containing a number of varieties.

8.1.1 Logical omniscience

A problem for referential semantics (which assigns semantic values to expressions in a compositional manner as part of how they explain language and meaning), is that the theory cannot distinguish semantically between different expressions that are assigned the same semantic value. Cases of a singular term denoting an object (or sometimes failing to denote), which have given rise to a lot of puzzles, are dealt with in section (7.3.2) below: In the present section I am concerned with the case of sentences.

If the reference of a sentence is its truth value, the innocent position becomes simply untenable, because if John believes a true sentence p , then from the truth of 'John believes that p ', we could derive as true all sentences

(1) John believes that q

for any other true sentence q (and similarly for false sentences). This is so because the semantics is compositional and only the references of the constituents of (1), one of which is the embedded sentence q , are relevant to determining the referent (truth value) of (1). If q has the same truth value, and hence reference, as p , the reference and truth value of the sentence arising from the substitution of q for p will be identical to that of the original.¹

The Fregean reaction is to abandon innocence, and say that the references of the embedded sentences in attitudinal contexts are the thoughts associated with them, the ordinary senses of these sentences. The hope is that the level of sense will be capable of making the finer distinctions required to prevent substitution of unwanted instances. Now Frege did not say very much about precisely what senses are; however, since Carnap and Church, intensions have been used to represent Fregean senses of expressions. This move does not solve the problem, though in a way it "reduces" it: the semantics is more sensitive and can discriminate more finely: Cases still

remain that cannot be distinguished, but which we want to be distinguishable. Logically equivalent sentences have the same intension, and thus cause problems. From 'John believes p ' we can derive, for any tautology t , the sentence

(2) John believes $p \ \& \ t$.

The typical example is where t is $q \vee \neg q$.

It has proved difficult to find a satisfactory and motivated refinement of the notion of intension, one that would serve to distinguish p from $p \ \& \ t$. Intentions discriminate among expressions down to the level of logical equivalence. This problem is known as the problem of logical omniscience, precisely because a semantics based on possible world semantics attributes to an agent who believes a sentence p , belief also in all sentences logically equivalent to p .

8.1.2 Substitution of coreferential singular terms

The problem of logical omniscience is a special case of the substitution of a coreferential expression; another case is that of terms, especially singular terms. The basic idea here is that if a person can be related to an object in more than one way, we may be able logically to derive contradictory beliefs on his part about that object. If he believes of the object, as related to it in one way, that it is such and such, we may also be able to say that he believes of the object, as related to it in another way, that it is not such and such.² Examples help to fix ideas about what is going on here. Since the literature overflows with examples, we shall be selective and consider only some representative cases.

I shall divide the examples into three groups: (i) cases where the agent is related to the object and has a relational (in the Quinean sense) belief -- the de re cases; (ii) cases where the object is the agent himself -- the de se cases;³ and (iii) cases where a problem arises when we try to explain someone's behaviour by the beliefs and desires he has (or that are attributed to him).

8.1.2.1 De re attitudes

This section can be subdivided according to whether the relation that the agent bears to the object is physical (typically perceptual) or nominal, ie. the relation is via language, as with a proper name. The classical example where the agent of an attitude meets an individual under two guises without realising that they are the same is Quine's story of Ralph and Ortcutt:

There is a certain man in a brown hat whom Ralph has glimpsed several times under questionable circumstances on which we need not enter here; suffice it to say that Ralph suspects he is a spy. Also there is a grey-haired man, vaguely known to Ralph as rather a pillar of the community, whom Ralph is not aware of having seen except once at the beach. Now Ralph does not know it, but the men are one and the same. Can we say of this man (Bernard J. Ortcutt, to give him a name) that Ralph believes him to be a spy? (Quine, 1956, p. 103)

Adding to Quine's story a little, that Ortcutt was wearing a brown hat and lurking around a military installation when Ralph saw him, we obtain as true both the sentences

- (3) Ralph believes that the man in the brown hat is a spy.
- (4) Ralph believes that the man seen at the beach is not a spy.

Since Ortcutt is the man in the brown hat and the man seen at the beach, under the substitution of coreferential terms, we are licensed, if all these expressions refer to Ortcutt (as an innocent theory says they must), to derive both of

- (5) Ralph believes that Ortcutt is a spy.
- (6) Ralph believes that Ortcutt is not a spy.

But we do not want both of (5) and (6); the question is which inference(s) to block, how to do so, and why.

Another example that is found in the literature, a slight variation, is Stephen Boer and William Lycan's (1980) case of Wilfred

and Van. Van is a mirror image of Wilfred, a reflection of Wilfred which John takes to be a different person. Thus, when John sees a tiger about to spring upon Wilfred, (7) is true, but (8) is false, for, so the story goes, John cannot see the tiger in the mirror and does not think that Van is about to be jumped on.

(7) John believes that Wilfred is in danger.

(8) John believes that Van is in danger.

The other kind of case is where one or both relations of the agent to the object are via language: an attitude report where the individual believed to be something or other by the agent, is referred to by a proper name. Most people today consider proper names to be singular terms that refer in a Millian fashion to the bearer of the name.⁴ Hence the contribution that the name makes to the reference of the whole sentence is just the individual who bears the name. In the examples:

(9) Andrew knows Hesperus is closer to the sun than the earth is.

(10) Andrew knows Phosphorus is closer to the sun than the earth is.

(11) Andrew knows that celestial body [demonstrating Venus] is closer to the sun than the earth is.

Venus is denoted twice by a name, and once by a demonstrative. Suppose Andrew has never heard the name Phosphorus, and has learned about Venus only from books (perhaps he is blind and has never even seen Venus), but he does know that 'Hesperus' is also a name for Venus. If (9) is true, then by substitutivity (10) should also be true, as should (11). These consequences of referential semantics, however, require defence or perhaps modification, for they take us to the limit of what we can tolerate.

8.1.2.2 De se attitudes

David Lewis has used the term 'de se' for attitudes towards oneself under a particular conception of oneself, namely, when one thinks of oneself as 'I'. John Perry has written about three kinds of 'essential indexical', one of which is de se, though the others are related cases. Perry has an example of a messy shopper in a supermarket, who sees someone pushing a trolley in mirrors; sugar is spilling from the trolley onto the floor, without the shopper realising that he himself is responsible and that the sugar is spilling from his own trolley. Perry argues for the essentialness and ineliminability of the indexical 'I' in the shopper's eventual realisation that he is spilling the sugar, which he would express by

(12) I am spilling the sugar.

Only when the shopper understands that he is the one spilling the sugar by thinking of himself under the mode of presentation specified by 'I' will he take appropriate action (straighten the packet of sugar in his trolley rather than chasing the "person" he sees in the mirrors).

The problem for a semantics of the attitudes is that one cannot substitute a coreferential term for 'I' in (12) and use the resulting sentence to explain why the messy shopper stopped running round the shelves, chasing the image in the mirror, and instead straightened up the bag of sugar in his trolley. This example brings us to the use of attitude reports in the psychological explanation of behaviour to highlight problems for semantic theory.

8.1.2.3 Psychological explanation of behaviour

By considering the role of attitude reports in accounts of behaviour, it is possible to exhibit and crystallise other puzzles posed by the attitudes which can be examined from a semantic viewpoint. It may be the case that a solution to the puzzle will involve a contribution from psychology as well as semantics, but

these puzzles are no less interesting for the semanticist. Lynn Rudder Baker presents and tackles a problem of this sort, which we shall consider, in her aptly titled article 'De re Belief in Action' (Baker, 1982b).

An instance of the problem arises with respect to the following scenario. On a table are two objects, a carved jade dish and a painted porcelain basket; Jones, who believes the objects are of unequal value, is standing at the table and is asked to remove the more valuable object.

After inspecting the dish and the basket, Jones says, as Smith had before him, 'I believe that this [demonstrating the basket], but not this [demonstrating the dish] is the more valuable.' On the basis of Jones' statement, we may ascribe to him the following de re beliefs:

(13) Jones believes of the basket that it is the more valuable.

(14) Jones believes of the dish that it is not the more valuable.

(p. 368; numbering by the present author)

However, before acting, Jones asks to handle the objects to confirm his judgement, which he is allowed to do blindfolded. Consenting to this condition, Jones says confidently, believing he is holding the basket, 'I believe that this [demonstrating the object he is holding] is the more valuable'. Of course, he is actually holding the dish, so we may ascribe to him the de re belief:

(15) Jones believes of the dish that it is the more valuable.

When the dish is replaced and the blindfold removed, Jones removes the basket.

If the belief attributions are correct,⁵ Jones believes of the dish that it is the more valuable, but also believes of the basket that it is the more valuable. There is a problem here already, for we can suppose Jones has sufficient knowledge of logic to know that both items cannot each be the more valuable; but Baker's interest is

the problem of how to explain his action of removing the basket? She shows that there is no explanation of Jones' action that could employ his de re belief (14), for occurrences of (14) in any proposed explanation could be replaced by occurrences of (15) to produce an "explanation" of an action that never happened; hence the proposed "explanation" does not explain Jones' action. The outcome is that 'de re beliefs concerning objects are deprived of the explanatory role they were assumed to have.' (pp. 379,380)

Lynn Rudder Baker's reaction is to suggest an account in terms of 'basic actions', actions about which an agent cannot be mistaken, which an agent successfully performs if he intends to do so. Jones intended to remove the object which he thought the more valuable, which at one point he thought was the basket (the visual examination) and at another point he thought was the dish (tactile examination); in effect he removes the basket. Basic actions are sufficiently "primitive" that the agent cannot be mistaken about what he is doing.

The explanation divides into two parts: firstly an intentional part which eschews de re belief ascriptions and instead identifies objects in a "primitive" way, one which captures the agent's point of view on objects -- his way of thinking of and identifying them. Thus (13) is replaced by

(16) Jones believes that the object he* pointed to first is
the more valuable.

(The '*' is Casteneda's symbol for attributing indexical reference.) We can ascribe beliefs that the object identified in such and such a way is identical to that identified in such and such another way, even if the objects thus identified are not identical. We can then formulate Jones' beliefs that all these objects (the one first pointed to, the one he held blindfolded secondly, etc.) are correlated with the two in front of him in a certain way. The second part of the explanation consists of statements of fact: that the object identified in such and such a way is in fact the basket (or the dish).

Baker suggests, in other words, that an explanation of Jones'

action requires us not to ascribe de re beliefs and employ these in the explanation, for that would be "jumping out of" Jones' perspective on his environment too soon; rather, the explanation requires us to remain within Jones' perspective until the entire intentional part of the explanation has been completed, only then can we bring in the world, brings in facts about which object Jones is thinking about. As Baker remarks, her style of explanation is congenial to Fodor's (1980) methodologically solipsist approach to psychology.⁶

This scenario therefore presents a challenge to situation semantics, to provide an explanation of Jones' action without retreating from its ecological stance to a methodologically solipsist position.

8.1.3 Exportation from attitude contexts

The final class of problem posed by the attitudes which we shall consider is that of exportation. When, if ever, can we logically derive (17b) from (17a) or (18b) from (18a)?

- (17) a. John believes a mouse is in the house.
b. A mouse is such that John believes it is in the house.
- (18) a. John believes many people smoke.
b. Many people are such that John believes they smoke.

The relation between the 'a' sentences and the 'b' sentences is unclear; Quine concludes that quantifying in is an altogether dubious business and confesses that he does not know how to make sense of the 'b' sentences.

If we allow wholesale exportation (which is the latitudinarian view),⁷ the Ralph and Ortcutt story shows how we run into problems. From (19a) we derive (19c) by exporting the singular term and legitimately substituting a coreferential term in an extensional context:

- (19) a. Ralph believes the man in the brown hat is a spy.
b. The man in the brown hat is such that Ralph believes he is a spy.
c. Ortcutt is such that Ralph believes he is a spy.

Elaborating Quine's story demonstrates that we really do not want (19c): suppose Ralph has seen Ortcutt at the beach and around town -- he knows him quite well, and would never think he is a spy. Nonetheless, it is Ortcutt whom Ralph glimpses in suspicious circumstances, without recognising him. Does he therefore believe of Ortcutt that he is a spy? The consensus among theorists is that he does not. Thus we have

- (20) Ortcutt is such that Ralph believes he is not a spy.

which, together with (19c), produces an inconsistency in Ralph's thinking, even although Ralph is quite rational.

More forcefully, suppose there is no mouse in the house, but (17a) is true; then surely (17b) is false. Otherwise we would be committed to exhibiting a (unique) mouse that made the sentence true. Or suppose the attitude is one of desiring a certain event, which may or may not come to pass, as in

- (21) Publius seeks the fall of the Republic.

Or suppose some early medieval explorer returns to Europe with tales of his adventures; suppose he believes he saw a unicorn: we do not want to allow exportation in the following instance:

- (22) a. Marco believes he saw a unicorn.
b. A unicorn is such that Marco believes he saw it.

Exportation must definitely be ruled out in cases of this sort. How does situation semantics deal with unicorns?

We shall consider one other case of exportation. The examples above have in common that the exported term is an indefinite description; definite descriptions also provide instances where

exportation is problematical. However, we shall look at the exportation of a name.

(23) a. The ancient Greeks believed Zeus lived on the summit of Mount Olympus.

b. Zeus is such that the ancient Greeks believed he lived on the summit of Mount Olympus.

If there is no such person as Zeus, nor ever was, then while we grant the truth of (23a), we shall regard (23b) as false.

8.2 Partiality and the attitudes

A stumbling block for possible world semantics is the fact that intensions are not fine enough to distinguish meanings, and hence one cannot distinguish semantically between certain sentences embedded in attitude reports which require to be distinguished. A case of this occurs with (24) and (25):

(24) Andrew believes that φ .

(25) Andrew believes that $\varphi \ \& \ (\psi \vee \neg\psi)$.

If Andrew believes that φ , then from the equivalence of the intensions of φ and $\varphi \ \& \ (\psi \vee \neg\psi)$, (25) is also true, according to possible world semantics, for all sentences ψ . If we grant the plausible principle that from

\underline{x} believes that φ and ψ

we may infer both of

\underline{x} believes that φ

\underline{x} believes that ψ

then from (25) we obtain

(26) Andrew believes that $\psi \vee \neg\psi$.

For many substitution instances, if not most, (26) will be false.

The possibility which situation semantics extends to us is that this puzzle could be solved by using situations to distinguish φ from $\varphi \ \& \ (\psi \vee \neg\psi)$. In fact, Barwise and Perry have explicitly claimed:

Situation semantics, and semantics innocence, resolve the problem of logical equivalence. Logically equivalent sentences, even in the same discourse situation, are not assigned the same proposition; different subject matters give different sets of situation types. This is the dividend of using partial functions freely in the development of situation semantics. (Barwise and Perry, 1981b, p. 677)

Unfortunately, the problem is not solved by partial functions and situations, but reappears in cases involving strongly equivalent sentences, with which Barwise and Perry replace logical equivalence. The sentences φ and $\varphi \ \& \ (\psi \vee \neg\psi)$ are not strongly equivalent. The result of having situations in the semantics has indeed been to make semantics more sensitive to subject matter, and to prevent the puzzle arising in such crude ways as in (25); but the same basic puzzle still arises in other instances:⁸

(24) Andrew believes that φ .

(27) Andrew believes that $\varphi \ \& \ (\varphi \vee \psi)$.

(28) Andrew believes that $\varphi \vee (\varphi \ \& \ \psi)$.

The interpretation of φ in an utterance of (24) is identical with the interpretation of $\varphi \ \& \ (\varphi \vee \psi)$ in an utterance of (27) in the same discourse situation (with the speaker connections extended if necessary to cover expressions in ψ). We have:

$$d, c \models [\varphi \ \& \ (\varphi \vee \psi)] = d, c \models [\varphi] \cup (d, c \models [\varphi] \cap d, c \models [\psi])$$

and clearly, whatever $d, c \models [\psi]$ may be, we have

$$d, c \models [\varphi] \subseteq d, c \models [\varphi] \cup (d, c \models [\varphi] \cap d, c \models [\psi]) \subseteq d, c \models [\varphi]$$

whence $d, c \models [\varphi \ \& \ (\varphi \vee \psi)] = d, c \models [\varphi]$. Similarly for (28).

Situation semantics has reduced the number of problematic cases, since (25) and many others no longer present puzzles; $d, c \llbracket \varphi \& (\psi \vee \neg \psi) \rrbracket \neq d, c \llbracket \varphi \rrbracket$, precisely because of the partiality in the semantics. Unfortunately, cases still remain which partiality in the semantics alone has not been able to prevent. (Indeed, one wonders what kinds of references are required for a semantics of the attitudes.)

8.3 Information, the quasi-linguistic status of the semantics, and the attitudes

Situation semantics is centred around the notion of information -- the word occurs many times in the first two chapters of Barwise and Perry (1983), where the authors lay out the philosophical background to their theory, and again in chapters nine and ten, where the attitudes are considered. The role of information makes situation semantics an attractive and exciting theory, for it means that working out and applying the theory entails studying traditional problems from a new and relatively unexplored perspective, and doing so within a formal framework.

The basic notion of information in situation semantics is Gibson's idea of information as objectively out there in the world. Information in this sense is closely related to situation semantics meaning, relations between situations. Barwise and Perry want to extend the concept beyond Gibson's intentions to include also information in the intuitive, everyday sense: a person seeing a bear approaching has detected this information and can communicate it to another person, who cannot see the bear, by uttering,

A bear is approaching.

For Barwise and Perry, the information that a bear is approaching is present in the second person's environment, in the utterance, just as it is present for the first person (although the form the information takes is different).

Hitherto referential semantics has considered the puzzles of the attitudes in terms of the references of expressions, mostly from a non-innocent viewpoint; situation semantics holds out the prospect of solving these puzzles in an innocent manner through involving the concept of information, which will be given a place in semantics. Can the notion of information be used to give a semantics for attitude reports, through providing a finer mesh than that of brute extensional significance? A semantic solution to the attitude puzzles seems to require such a finer mesh; yet how might we achieve this without abandoning semantic innocence?⁹

How do we quantify information? How do we measure it or specify it? Dretske gives a de re account: information is always to the effect that a source s is F. Barwise and Perry agree substantially with Dretske, but they also invoke the Gibsonian or ecological notion of information. Their agreement with Dretske resides mainly in their common view that information is objective and prior to language, which makes it the key concept in an explanation of cognition. Dretske shows how we might understand knowledge and belief in terms of information; for Barwise and Perry, the fundamental property of language is that it can be used to convey information. From Gibson they adopt the idea that information arises out of animal/environment interaction. Fortunately, in semantics we need only concern ourselves with the information that humans glean in situations and that can be expressed in language.

The concept of information is effectively a primitive notion in situation semantics; if we want to know more, we are referred to work in the ecological tradition (eg. Michaels and Carello, 1981; Gibson, 1979) and to Dretske (1981). Information is prior to language, something out there in the world, but not simply the way the world is either. Suppose Jackie has a broken leg. There is this fact, that Jackie has a broken leg; there is the proposition that Jackie has a broken leg; and there is the information that Jackie has a broken leg.

In earlier chapters, notably chapter five, I argued that the level of abstract situations is essentially a quasi-linguistic level

of representation, with abstract situations representing potential, partial states of the world. Our intent is to discover in the course of examining the traditional puzzles of attitude reports (as laid out in chapter seven) from the perspective of a representational view of abstract situations, whether situation semantics can advance us towards a solution of the puzzles.

8.3.1 Logical omniscience

The puzzle with logical omniscience is that possible world semantics cannot distinguish the meaning of p from the meaning of $p \ \& \ t$, where p is a sentence and t is a tautology. This is so because possible world semantics identifies meaning with intension, ie. the meaning of p is the set of all possible worlds in which p is true, and, since t is always true,

$$\hat{(p \ \& \ t)} = \hat{p} \cap \hat{t} = \hat{p}.$$

We have already seen that the partiality of situation semantics reduces the magnitude of this problem, but the fundamental difficulty remains: sentences p and q can be syntactically distinct, yet be assigned the same interpretation.

Referential semantics assigns a semantic value to expressions of the object language. however, if the language is efficient, this assignment will not be a function: a given syntactic expression may take distinct semantic values on different occasions. Moreover, distinct expressions can have identical semantic values on occasion, even in artificial logical languages, where one can often refer to an individual by means of any of several expressions.

The situation is altered when semantics is fragmented into two levels, meaning and interpretation, in situation semantics terminology. The difficulties in relating syntax to semantics involved the semantic value or interpretation; the relation between syntax and interpretation is many-many. The meaning/interpretation structure of situation semantics proves extremely flexible, for we

now have a mapping between syntax and semantic meaning, and meaning is a function from discourse situation and speaker connections to interpretation.

This is a case where the notion of information could play a significant role, by individuating the world more finely. The information that p is not identical to the information that $p \ \& \ \underline{t}$, even when \underline{t} is a tautology.

It is interesting to notice that this is a point at which Barwise departs from Dretske's view of information. In his commentary on Dretske (1983), Barwise raises just this point with regard to the probabilistic underpinings of Dretske's theory:

[...] the probabilistic account misses the point when it comes to linguistic events. The issue is not whether the probability of your having the 'flu is 1, but whether the doctor has the information and intends to convey it to you in saying 'You have the 'flu'. Or suppose that Fermat's last theorem is false. On the probabilistic account, this information is carried by every situation. Yet surely there is a transfer of information in my telling you an explicit counterexample that is not in a situation like a sunset. (Barwise, 1983a, p. 65)

In his reply, Dretske admits he has difficulty in dealing with necessary truths, which on his probabilistic approach do not generate any information, since if an event is necessary, there are no relevant alternative occurrences. Barwise, on the contrary, believes that an utterance of a counterexample to Fermat's last theorem contains information which is not in a sunset, and hence believes that information is associated with mathematical truths. If Barwise is right, the notion of information is suitable for discriminating among the sentences or utterances that neither possible world semantics nor a semantics with partiality can distinguish.

Syntactically, the sentence $\varphi \ \& \ \psi$ is not identical to $\psi \ \& \ \varphi$, yet semantically there is nothing to distinguish them in situation semantics: they have the same interpretations.¹⁰ Indeed, one would find it difficult to motivate a semantics which did not assign them identical references and in which one could be true without the other being true. If

(29) John believes that ϕ .

is true and $\phi \Leftrightarrow \psi$ (that is, ϕ and ψ are strongly equivalent, they have the same interpretation), it does not follow that

(30) John believes that ψ .

is true, although the semantic theory cannot distinguish between their references. The syntactic difference between ϕ and ψ can be crucial, their semantic equivalence notwithstanding.

8.3.2 Substitution of coreferential singular terms

This promises to be a fruitful area for the application of the notion of information, since as Barwise and Perry often point out, there is information associated with utterances which employ one referring expression which is not carried by utterances employing other referring expressions.

The fact that situation semantics provides us with structured interpretations for utterances and for subsentential expressions within utterances, and that we are regarding these structures as representations of states of the world (or parts thereof), seems to offer a way of treating the puzzles with attitude reports. Our intuitive understanding of the various scenarios involved in the puzzles usually appeals to the idea that the agent of the attitude has different concepts or representations of the object. For example, Ralph has met Ortcutt twice in widely differing circumstances: once at the beach and once near a military installation, hence he has two representations of Ortcutt without realising that they represent the same individual.

8.3.2.1 De re attitudes

Consider the story of Ralph and Ortcutt. The information

potentially communicated by an utterance of (31) is distinct from that communicated by an utterance of (32), and distinct again from the information communicated by an utterance of (33).

(31) Ralph believes the man in a brown hat is a spy.

(32) Ralph believes the man seen at the beach is a spy.

(33) Ralph believes Ortcutt is a spy.

If the descriptions are used referentially, they designate Ortcutt and the interpretations of all three utterances are identical. Yet referential uses of definite descriptions, like names, convey inverse information -- that someone (Ortcutt) is the man in the brown hat, that someone (Ortcutt) is the man seen at the beach, that he is called 'Ortcutt'; further inverse information which might be communicated is that the speaker knows that someone (Ortcutt) is the man in the brown hat, etc.

We have established that the information associated with and conveyed by utterances of (31) to (33) is different, but is this information semantically relevant? On the narrow semantic view, the domain of semantics is confined to the interpretations of expressions; information as such is irrelevant, only the semantic value, or at most what the utterance says about the state of the world (the proposition expressed) matters. Valid inference is founded upon the the notion of truth, and the truth of an utterance depends upon the state of the world. As the puzzle arises because certain inferences which we do not want come out true in semantics, talk of information does not affect the semantic puzzle. If Barwise and Perry think they are altering the semantic status of the puzzle, they are thinking of semantics in a very wide sense indeed, for wide semantics as I defined it in chapter two involved the level of meaning only in so far as meaning was relevant to determining interpretation (reference). That definition does not imply that information has a role in fixing which inferences are true.

The concept of information could be extremely useful in solving this puzzle, but if the solution is to be a semantic solution,

information must be given a semantic role. The question of whether we should adopt a narrow or wide semantics is irrelevant as far as any possible solution to the current puzzle based upon the notion of information is concerned.

When we come to treat the puzzle of Ralph and Ortcutt from the perspective of regarding the level of abstract situations as representations, we are confronted with the fact that, although our intuitive understanding of Ralph's beliefs invokes different representations or ideas of Ortcutt, it is Ortcutt himself, the "bare" individual, that occurs in the abstract situation to which Ralph is belief-related. The abstract situation is constructed out of Ortcutt and the property of being a spy, both of which are real world entities, but the abstract situation itself is not a piece of the world; the representational status attaches to the situation. On the other hand, at the linguistic level, the difference between (31) and (32) seems to lie with the terms 'the man in the brown hat' and 'the man seen at the beach'. The representational status of the abstract situation in which Ortcutt is a spy does not help here.

As we noted above, referential uses of definite descriptions involve inverse information, which means that there is information available, but not as part of the interpretation. There is a resource situation e_r for an utterance of (31), such that Ralph is the unique man in a brown hat in e_r . We pick out Ortcutt as a constituent for the interpretation of the entire utterance by finding him in e_r , where he is not a "bare" individual, desolate of properties. At the very least, he is the man in the brown hat, and quite likely possesses many more qualities. The mesh of relations into which Ortcutt is integrated is kept out of sight in the wings, as it were, and only Ortcutt himself appears in the interpretation.

8.3.2.2 De se attitudes

Perry's argument in his (1979) is that there is a difference between the propositions expressed by utterances of the following two

sentences that a semantic theory must attempt to capture.

(34) That person [demonstrating the person in the mirror] is
spilling the sugar.

(35) I am spilling the sugar.

Can the difference Perry is referring to be caught with the notion of information? The difference must lie in what is expressed by the expressions 'that person' and 'I'. Since Perry's point is that the referring expressions 'the person in the mirror', 'he [demonstrating the person in the mirror]', or 'the person spilling the sugar', share with 'that person' in (34) a lack of something that the expression 'I' alone has. The difference has to do with the indexical 'I', which suggests that we look at the meaning of 'I' in situation semantics to see if this particular pronoun conveys some piece of information that sets it apart from all the others.

The meaning of 'I' is given by

$\langle d, c \rangle \llbracket I \rrbracket \sigma, e$ iff $a = a_d$.

and fixes as referent the speaker of the current discourse situation. Other referring expressions will identify him in a variety of ways (cf. the examples above, which include a demonstrative, an indexical, and a definite description). It is the method whereby the meaning of 'I' fixes the referent which allows Barwise and Perry to talk of inverse information conveyed by uses of 'I': when Jim introduces himself to Melanie by saying 'Hi, I am Jim', the information that Melanie gets is that the person speaking to her (Melanie) is Jim (S&A, p. 200). This information contrasts with that which would be conveyed by Jim's uttering 'Hi, the youngest person in the room is Jim'.

The messy shopper's use of (35) contains the information that the speaker is the person making the mess. If the shopper is Perry himself, the information is not simply that Perry is making a mess, for this information is also contained in utterances of (34) or utterances employing the other referring expressions mentioned above. Identifying the individual is not enough; it misses the point.¹¹ The

point is what Perry was dealing with in Perry (1977, 1979, 1980). With regard to the messy shopper, he says:

[...] the importance of the word 'I' in my expression of what I came to believe. When we replace it with other designations of me, we no longer have an explanation of my behavior and so, it seems, no longer an attribution of the same belief. It seems to be an essential indexical. (Perry, 1979, p. 3)

In a later paper, the point is expressed more clearly:

The importance of the word 'I' is not that everyone who has beliefs about himself must use it, or an indexical like it, to think of himself. Rather, it is that because its role in thinking is tied to its meaning, it can be used to characterise that cognitive role in a general way. To accept 'I am so-and-so,' a person need not understand the word 'I', but only be in a state that, were he to understand 'I', would lead him to use 'I am so-and-so'. (Perry, 1980, p. 540)

In his paper on Frege, Perry (1977), it is claimed that the way a person has a thought -- the sense he entertains -- matters as well as the thought thus apprehended, because it is the former that connects with behaviour.¹² The emphasisⁱⁿ Perry (1980) lies more with language and the way we use certain words; yet there is still a cognitive role that words characterise. The word 'I' involves the appropriate cognitive role; the other expressions, although designating the correct individual, do not.

Returning to the example of Jim's introduction of himself to Melanie, Melanie learns information that she will find useful for her future behaviour, perhaps uttering 'Oh, hi, Jim!' The description 'the youngest person in the room' might leave her wondering what her interlocutor was talking about. Consider an alternative situation:

Imagine that you are my addressee, that we speak often about how outrageous James Watt, the Secretary of the Interior is, and that we are at a reception for the Queen of England at which Watt is present. Further imagine that Watt is speaking into a microphone while moving around the room, so that we can hear him, but have no idea where he is at the moment. After some particularly outrageous remark of Watts, I say 'That man is

outrageous.' Clearly, Watt is the referent, the reference certainly seems to be a straightforward demonstrative reference, and yet nothing like a spatial relation determines the reference. (Wettstein, 1984, p. 77)

Wettstein is concerned to argue against McGinn (1981) that reference is determined by spatial relations, and instead that it is determined by 'the very features [of the context of utterance] which make the reference available to the auditor'. (Wettstein, 1984, p. 64) In this example, the link between speaker and hearer on the one hand, and the referent on the other, is via the auditory channel, for that is how the pair are related to Watt.

Information, certainly as Gibson employs the notion, is tied to action, and promises to prove a convenient basis for explicating our descriptive, explanatory, and predictive practices, and hence account for our intuitions about the puzzles.

8.3.2.3 Psychological explanation of behaviour

We presented as a puzzle of this sort the task of explaining Jones' action of removing the basket from the table rather than the dish. The semantic component of the puzzle arises from attributing to Jones de re beliefs of both the basket and the dish.

(36) Jones believes of the basket that it is the more valuable.

(37) Jones believes of the dish that it is the more valuable.

Lynn Rudder Baker traces the problem with attempted explanations in terms of de re belief attribution in (36) to the tendency to escape from the intentional sphere into the external world before completing the intentional part of the explanation. Her position embraces a separation of what is relevant for the agent's cognition and what is the state of affairs holding in the world, a position which some find acceptable (Fodor 1980), but which is strongly rejected by ecological theorists and which therefore Barwise and Perry might also be

expected to reject.

The analysis of (36) and (37) that situation semantics provides already encapsulates the puzzle. The inverse information available in utterances of these sentences does not rescue the explanation in terms of de re beliefs, and is unable to resolve the puzzle.¹³

8.3.3 Exportation from attitude contexts

The problem with exportation is that in many cases the sentence which results from exporting a term from within the scope of an attitude verb simply is not entailed by the original sentence. The inference from (38a) to (38b) is not valid:

- (38) a. John believes a mouse is in the house.
- b. A mouse is such that John believes it is in the house.

Situation semantics blocks this inference in an elegant and satisfying way.

We can give the indefinite description 'a mouse' in (38a) either a referential, an attributive or an inner attributive reading (to use situation semantics terminology). On the referential reading there is only one mouse, a particular individual, which John believes is in the house. In this case the inference is fine, although utterances of (38a) would not normally involve this reading. On the attributive and inner attributive readings, there are many mice and John's belief is not of a certain mouse, so that the inference is invalid. In general, therefore, and especially with utterances of (38a) under ordinary circumstances, the inference is invalid.

Each situation in the interpretation of an utterance of (38a) relates John to a schema, which consists of the event type

$$\{\langle \underline{l}, \langle \text{in}, \underline{h}, a \rangle, 1 \rangle\}$$

where \underline{h} is the house, $\underline{l} \circ \underline{l}_d$, and a is an indeterminate which will be

anchored to various mice. When the indefinite description is intended referentially, all the situations in the interpretation of an utterance of (38a) contain a certain mouse which John believes is in the house, therefore *a* must be anchored in each case to the particular mouse in question. When the description is intended attributively or inner attributively, the interpretation is expanded to include situations relating John to this same schema, but in which the indeterminate *a* may be anchored to other individuals which are mice in either the situation designated by the entire utterance or the situation designated by the embedded sentence 'A mouse is in the house'.

The indefinite description in utterances of (38b) is generally a referential use, but it may be used attributively. On the referential reading there is a certain mouse which John believes is in the house; on the attributive and inner attributive readings, there are again several mice, and the interpretation can be partitioned into subclasses I_m indexed by the mouse which in question in each situation in I_m . The explanation situation semantics provides for the failure of the inference generally is that (38a) is typically given an attributive reading and (38b) is typically given a referential reading; in this event the interpretation of (38a) is not a subclass of the interpretation of (38b).

With regard to the medieval traveller Marco, who returns to his native city believing that he saw a unicorn in a distant land, the sentence

(39) Marco believes he saw a unicorn.

poses a serious problem for situation semantics as an innocent theory. The embedded sentence 'He saw a unicorn' should have the same interpretation within (39) as outside, and consists of situations containing the constituents: Marco, seeing, and -- some unicorn. Since there are no unicorns, we have a problem in providing one as a constituent for the situation.

There are two paragraphs in Barwise and Perry (1983) on fictional discourse and "fictional individuals" (pp. 284, 285).

Barwise and Perry suggest the use of indeterminates to stand for such creatures, so that utterances describe not situations, but situation types; the difference between instances of reference to real world individuals and instances of reference to "fictional individuals" is that there is no anchor for the indeterminates in the latter case.

There is no Santa Claus. Still, there is objective content to our talk of Santa Claus, as when I say, 'Joe believed that Santa Claus gave him his bike,' and there are concepts that embody our ideas of Santa Claus; there are connective links across the culture between various uses of SANTA CLAUS. But the concepts that embody these ideas are not concepts of any real individual. (S&A, pp. 284,285)

This proposal means, however, that we have to be content with situation types as the interpretations of some utterances.¹⁴

Such a proposal constitutes the basis for Barwise and Perry's response to the puzzle presented by an instance of a name being exported. In fact, since innocent semantics regards interpretations of expressions as independent of the linguistic context in which they occur, there is no problem with the exportation in the case:

- (40) a. The ancient Greeks believed Zeus lived on the summit of Mount Olympus.
- b. Zeus is such that the ancient Greeks believed that he lived on the summit of Mount Olympus.

that is not already existent with (40a) alone.

The concept of information, if given a place in semantics, is helpful to Barwise and Perry's theory. The important property of information is that it is always veridical (Dretske, 1981, p. 45). Can we make use of this fact to solve the puzzle? As we saw the semantics as presently formulated (in which only a part of the information associated with an utterance is contained within the interpretation) can handle some cases of exportation satisfactorily. By distinguishing a variety of possible readings for descriptions, it can explain the failure of the inference from one sentence to another, in which a term has been exported.

However, consider the problem which arises with the inference from (39) to (41):

(39) Marco believes he saw a unicorn.

(41) A unicorn is such that Marco believes he saw it.

The present proposal is that 'a unicorn' designates an unanchored indeterminate; the problem is that with this state of affairs we cannot obtain the result that (39) can be true and (41) false. If we say that (41) is false, because the indeterminate is not anchored to any real world individual, why should not (39) be false for the same reason? Or if we regard (39) as true, why should not (41) be true also? It is the problem of semantic innocence again.

The semantic theory should declare (41) false; the notion of information, if radically incorporated into a semantics, can explain this result, for there being no unicorns means there is no information originating with unicorns. We have a principled, rather than arbitrary, decision for declaring (41) false.

Sentence (39) presents more of a problem; here the representational aspect of the level of abstract situations is of help. It is quite possible for there to be a representation of something which does not exist; indeed, the abstract situation in which Jackie is biting Molly at a location 1, when actually at 1 Jackie is not biting Molly, is precisely that. However, we do not have a unicorn with which to build a representation of Marco's seeing the unicorn.

Marco, we shall suppose, is not credulous and is quite rational; he did see some strange, unknown animal on his travels, but it was not a unicorn. So far we have facts. The problem originates when Marco categorises his experience in terms of seeing a unicorn, thus creating a belief about his experience -- a belief that he saw a unicorn. Barwise and Perry's strategy for understanding what we mean when we attribute an attitude breaks down with fictional and mythological reference, simply because there is no external significance, in terms of which we might understand the mental

significance of these reports.¹⁵ In fact, with an attitude report such as (39), we are employing more than the external significance of the constituents, if the external significance of 'unicorn' amounts to the fact that there are none. We make reference to concepts of unicorns and a common lore (cf. the above quotation from Barwise and Perry, 1983 about Santa Claus). What is missing from Barwise and Perry's account is the fact that we can appeal to more than the veridical in categorising attitudes.¹⁶

A combination of the representational status of abstract situations and the link with truth via information may provide a successful semantic theory for the attitudes within a situational framework -- certainly the question is worth exploring further.

Chapter Nine: General Conclusion

9.1 Accomplishments

One of the fundamental ideas of insights of situation semantics is that language is used primarily by finite agents to communicate information. Since information is regarded by the theory as existing in the world objectively, as Gibson and Dretske have argued, Barwise and Perry believe and claim that the meanings and interpretations of expressions are things in the world, parts of reality which exist independently of the speaker or language community. We have questioned this claim and attempted to demonstrate that abstract situations are quasi-linguistic entities.

The meaning of a sentence is a relation between situations, and its interpretation on an occasion is the described situation. The meaning of a basic expression is a relation between discourse situations and its interpretation, which is a part of the world: an individual or a property. However, as we saw in chapter five, abstract situations have displaced real situations as the references of utterances, because the latter do not have a suitable structure for semantic theory and because some utterances are false, so they do not describe the way the world is. The same problem demolished the early views of Moore and Russell, that propositions were parts of the world. Moreover, the combined role of the setting and distinguished indeterminates in compositionality demonstrates that the interpretations of the parts alone do not constitute the abstract situation, that is to say, situation semantics fails the principle of strong compositionality. Thus, the manner in which the parts are put together must be constrained. In effect, the setting binds together the internal structure of the abstract situation and the internal structure of the sentence uttered, which is the source of the constraints.

The examination of the "classificatory" role abstract situations are said to have concentrated on the position of abstract

situations within the theory. It was demonstrated that in fact they do not have a classificatory role, but are themselves the objects of the theory. In this picture, the use of the set theory, which is employed to hold entities that have a semantic role together within abstract situations, becomes a crucial indicator of the status of abstract situations and other semantic entities.

We showed how the semantic entities of Barwise and Perry's theory could be treated as expressions in a language, and the semantics as a whole recast within this framework, making the linguistic nature of abstract situations explicit by replacing the set theory with the operation of linguistic concatenation. The resulting picture is an extension of the one Richards (1974) proposed, in which propositions are composed of individuals and predicates held together linguistically. In the recast version of situation semantics, propositions or abstract situations are composed of individuals, properties and locations linguistically bound together (with polarity being explicitly signalled, rather than treated as an operator). Compared to Barwise and Perry's version of the theory, the formal equivalence of these two formulations shows that nothing has been lost in recognising the quasi-linguistic nature of propositions. (The recast version, however, contradicts some metatheoretical claims about the view of meaning proposed in situation semantics, but since these are not borne out, they are in need of revision in any case.)

When once one has begun to introduce structured entities as sentential references into the semantics, it becomes difficult to know where to stop. Barwise and Perry have introduced abstract situations as the references of sentences; the assertion made by atomic sentences can be specified by a single relation holding among suitable individuals (at a location); the assertion of attitude reports, too, can be specified in this way, as the belief relation holding between an agent and a schema. But molecular sentences, such as conjunctions, disjunctions and sentential negation, cannot be specified in this fashion, unless additional machinery is introduced into the semantics. Why should we not do this then? Robin Cooper

has argued that it is necessary for an adequate treatment of negation, and I have extended his argument for introducing molecular situations (molecular facts) to "quantified facts". The consequence of these additions is to add to and make more apparent the syntactic structure of abstract situations.

Situation semantics was hailed as a radical new approach to the semantics of natural language (and the theory is now also being applied to programming languages at the Center for the Study of Language and Information, Stanford University). It appeared to be quite different in a number of respects: the use of situations as sentential references, the claim that meaning and information are in the world rather than in the head, and the allied assumption that predicates refer to (intensional) properties. The relations between these theories were investigated using the technique of Kaplan (1975), which is to reformulate the interrelationships among the entities in each theory which have a semantic role. For a more comprehensive analysis, we added a semantics for necessity and possibility to situation semantics, which brought out the parallels with possible world semantics. Detailed analysis of the relation of situation semantics to other theories shows that these differences are not differences at a deep level. Especially when compared to Russellian semantics and direct reference semantics, similarities come to the fore.

The main task, then, was to examine the structure of the formal part of situation semantics with respect to the claim that meaning is in the world. By detaching this metatheoretical claim from the technical theory and analysing the latter in detail, we were able to show that situation semantics is formally equivalent to a recast version of the semantics which makes explicit the language-dependent character of propositions. It is clear, therefore, that when the situation semantics is considered apart from the metatheoretical claims, it is not quite so radical as first appears.

To regard the theory in this way is, however, not to minimise the contribution which the theory makes to semantics. On the contrary, the theory provides crucial insights, among which is the

idea that the notion of information is a significant, but neglected one for semantics. Barwise and Perry have not succeeded in locating meaning in the world independent of language, and therefore have not broken with traditional theory in this respect, but they have drawn our attention to the important question of the place of information in semantic theory.

We defined two views of the province of semantics, the narrow and wide approaches, and pointed out that situation semantics was a wide theory in this sense. Meaning has a crucial role, being a relation between discourse situations and described situations, and is the locus in the formal theory of the informational relations and constraints that are important for Barwise and Perry's view. The interpretation is only a part of the information available in an utterance of an indicative sentence, the remainder -- the inverse information -- being carried by the meaning of the sentence.

What are the benefits that situation semantics has brought us in the semantics of the attitudes? We considered a number of puzzled which have resisted solution for some time, and if situation semantics permits some advance towards solving them, it will have made a substantial contribution. The partiality of situation semantics fails to solve the problem of logical omniscience, but it does reduce the number of problematical cases. The notion of information, however, can distinguish cases which partiality alone fails to separate.

The concept of information and the representational status of abstract situations do seem to be useful in providing solutions for the other puzzles we looked at, or suggesting where solutions might be found. The properties of information which make it a valuable concept in this regard are its intensionality, the fact that it enables us to make finer distinctions than can be made at the level of interpretation, and the fact that it is veridical. The representational status of abstract situations provides them too with an intensionality which makes them useful tools for constructing a solution to the puzzles, while the facts that representations need not reflect reality makes them complementary to the notion of

information.

9.2 Situation semantics and future research

The intense interest shown in situation semantics since work first began to be published, if continued, indicates that the approach will be the centre of much activity and development. The theory embraces a relatively unexplored view of meaning and information, and provides structured interpretations for sentences; it is to be hoped that some results will be forthcoming from study within this framework.

As I said in the preface, work at CSLI has already moved beyond the theory published in Barwise and Perry (1983). The more recent theory stands in the same position as that version with respect to the points that I have made about the language-dependent status of meaning and sentential interpretations, and about the role of information. If it is indeed the case, as seems likely, that linguistic meaning is irreducibly language-dependent, then no theory can ever escape this fact. (The kind of information and meaning which ecological psychologists have been studying, the information that is detected during perception by both humans and animals, is another matter. Gibson may be right that meaning and information of this kind -- concerned with physiological rather than cognitive functions -- are in the world. See Gibson, 1979; Lee, 1976, 1980; and especially Turvey *et al.*, 1981.) There remains considerable scope for working out within the new version of situation semantics the place of information in semantics theory.

One area in which situation semantics has something valuable to contribute is that of the relation between a language and those who speak it. The combined interest in natural language and programming languages at CSLI reflects this concern with finite agents using language. One response to the question of what the speaker knows when he knows the meaning of a sentence is that he knows its truth conditions. This response was prompted by classical model theory,

eg. possible world semantics, in which the meaning of a sentence is its intension, the set of all possible worlds in which the sentence is true. In situation semantics, to know the meaning of a sentence, it is sufficient to know which situation or situations it describes when uttered in a given discourse situation. Conspicuously, the classical answer lacks partiality, for it involves total states of the world being bound up with the meaning of every sentence. Partiality in situation semantics has valuable insights to offer in this area.

We have considered the semantics of attitude reports, which is a part of the philosophy of language. It may be that situation semantics casts philosophical light on the ecological approach to cognition, in which case the theory will have consequences for the philosophy of psychology. These two disciplines have had considerable mutual influence in the past, and it is reasonable to suppose that the situation will not be different in the near future. Specifically, Fodor's (1980) rather pessimistic conclusions on the future of naturalistic psychology are rejected by the ecological school (see the commentary on Fodor's article by two ecological psychologists, Turvey and Shaw, 1980).

Finally, mention should be made of the application of situation semantics to various natural language constructions. In this area one hopes that there will be more than a simple reformulation of old results in a new framework -- that is the danger. In this respect I would like to make a few remarks about research on prepositions which Mark Gawron has carried out (Gawron, 1984). Gawron contrasts situation semantics, where information about argument order is not encoded into meanings, with the alternative practice of building such information into meanings. The significance of this choice is that semantic meaning and grammatical function are held separate, and greater parsimony can be exercised among meanings. Thus, Gawron wants to claim that the verb 'to hit' has a single meaning in both the sentences:

- (1) John hit the fence with the stick.

(2) John hit the stick against the fence.

(The sentences themselves are assigned different meanings in Gawron's system.) Of course, situation semantics is not the only possible theory that has this advantage; but applications of the theory must be examined and evaluated, and the theory judged with respect to its contribution relative to its rivals across a number of areas.

Appendix^{*}

The purpose of this appendix is to provide a rigorous definition of the algebra $(\underline{G}, *)$, various elements of which can be regarded as: interpretations of expressions, settings (on the original conception), and situations. The operation $*$ represents the operation of the composition of interpretations, or the combination of an interpretation with a setting. As indicated in the main text, the elements of \underline{G} will be represented as infinite matrices, but since we are interested only in a subset of $\underline{M}_{\omega, \omega}$, we need firstly to define the set \underline{G} .

The elements of a matrix $\underline{g} = (g_{ij}) \in \underline{G}$ must be taken from the union of the following sets, which, except for the last, arise in the model theory of situation semantics: the set \underline{A} of individuals, the set $\underline{R} = \bigcup_n \underline{R}^n$ of relations, the set \underline{L} of locations, and the set $\{1, -1, 0, \perp\}$. The elements 1 and -1 are the truth values true and false respectively, 0 is a "blank" or an indeterminate element, and \perp is an element which signifies that a position in the matrix has become informationally corrupt.

We shall complete the definition of \underline{G} and define $*$ by firstly defining a set \underline{G}^1 of vectors and an operation $*_{\underline{R}}$ on \underline{G}^1 . \underline{G}^1 is the set of all $\underline{g} = (g_{ij}) \in \underline{M}_{1, \omega}$ satisfying the following five conditions:

- (G1) For each element \underline{g} in \underline{G}^1 , g_1 is either a location $\underline{l} \in \underline{L}$, 0 or \perp .
- (G2) For each element \underline{g} in \underline{G}^1 , g_2 is either 1, -1, 0 or \perp .
- (G3) For each element \underline{g} in \underline{G}^1 , g_3 is either a relation $\underline{r} \in \underline{R}$, 0 or \perp .
- (G4) For each element \underline{g} in \underline{G}^1 , the elements g_j ($j > 3$) are either individuals $\underline{a}_j \in \underline{A}$, 0 or \perp .
- (G5) For each element \underline{g} in \underline{G}^1 , if $g_3 = \underline{r}$ for some $\underline{r} \in \underline{R}^n$, then the elements g_j ($j > n+3$) are all 0 or \perp .

We can now say that \underline{G} is the set of all matrices \underline{g} in $\underline{M}_{\omega, \omega}$ such that each row \underline{g}_i of \underline{g} ($i \in \omega$) is in \underline{G}^1 .

The operation $*_R$ is defined on the set \underline{G}^1 as follows. There are two cases we have to consider:

Case (1): If $g_3, h_3 \in \{0, 1\}$, the elements $(g * h)_j$ are defined by:

$$\text{For } j = 1, 2, \dots, (g *_R h)_j = \begin{cases} g_j & \text{if } g_j = h_j \text{ or } h_j = 0 \\ h_j & \text{if } g_j = 0 \\ 1 & \text{otherwise} \end{cases}$$

Case (2): If $g_3 = \underline{x} \in \underline{R}^n$ and $h_3 = \underline{x}' \in \underline{R}^{n'}$, for some $\underline{x}, \underline{x}', \underline{n}, \underline{n}'$, then let $\underline{m} = \max\{\underline{n}, \underline{n}'\}$. If either $g_3 = \underline{x} \in \underline{R}^n$ and $h_3 \in \{0, 1\}$, or $h_3 = \underline{x}' \in \underline{R}^{n'}$ and $g_3 \in \{0, 1\}$, then let $\underline{m} = \underline{n}$. The elements $(g *_R h)_j$ are defined by:

$$\text{For } j = 1, 2, \dots, \underline{m}+3, (g *_R h)_j = \begin{cases} g_j & \text{if } g_j = h_j \text{ or } h_j = 0 \\ h_j & \text{if } g_j = 0 \\ 1 & \text{otherwise} \end{cases}$$

$$\text{For } j > \underline{m}+3, (g *_R h)_j = \begin{cases} 0 & \text{if } g_j = h_j = 0 \\ 1 & \text{otherwise} \end{cases}$$

This completes the definition of $*_R$.

The reader may easily check that $(\underline{G}^1, *_R)$ is a commutative semigroup with identity: \underline{G}^1 is closed under $*_R$, $*_R$ is associative and commutative, and there is an identity element \underline{e} such that $\underline{e}_j = 0$ for each $j \in \omega$.

We want the operation $*$ to be defined so that, intuitively, the matrix $g * h$ ($g, h \in \underline{G}$) consists of the products of combining every row g_i of g with every row h_j of h according to $*_R$. To do this, we must choose an enumeration of all pairs $\langle i, j \rangle$ of natural numbers (for example, an enumeration may be obtained by diagonalisation). Given our chosen enumeration and a natural number \underline{n} , we shall suppose there are two functions p_1 and p_2 such that $p_1(\underline{n}) = i$ and $p_2(\underline{n}) = j$, where $\langle i, j \rangle$ is the \underline{n} th member of the enumeration. The operation $*$ can now be defined: for each \underline{n} , with $g, h \in \underline{G}$,

$$(g * h)_n = g_{p_1(n)} *_{\mathcal{R}} h_{p_2(n)}$$

The closure of \underline{G} under $*$ follows immediately from the closure of $*_{\mathcal{R}}$.

At this stage some remarks on our use of matrices to represent interpretations, settings and situations are in order. We are really only interested in equivalence classes of the matrices defined here. The matrices themselves carry too much information; that is, they make distinctions we do not actually want. The unwanted information must therefore be factored out by an equivalence relation.

As a first approximation, two elements of \underline{G} are in the same equivalence class if there is a permutation of the rows of one to make it identical with the other. However, defining the equivalence classes in terms of permutations on the rows of the matrices still leaves a too strong restriction on which matrices are in the same equivalence class, because it ignores possible repeated rows. Given the intuitive motivation, if two matrices are such that one results from the other by, say, repeating the first row and shifting all other rows down one, we want them to be equivalent; but this is not necessarily the case when the equivalence relation is defined by permutations. Hence we shall adopt the following definition for the equivalence relation, denoted by \mathcal{Q} :

$$g \equiv h \pmod{\mathcal{Q}} \text{ if } (\forall i)(\exists j)(g_i = h_j) \ \& \ (\forall i)(\exists j)(h_i = g_j)$$

Notice that if h is obtained from g by permuting rows, $g \equiv h \pmod{\mathcal{Q}}$. In the sequel we shall think of $(\underline{G}, *)$ as implicitly filtered through this equivalence relation. Strictly speaking, however, the intended algebra is $(\underline{G}/\mathcal{Q}, *)$, where $\underline{G}/\mathcal{Q} = \{[g] | g \in \underline{G}\}$ and $*$ is now defined on the equivalence classes $[g]$ in the manner that one would expect:

$$[g] * [h] = [g * h]$$

Because we need only these equivalence classes of matrices, in choosing matrices as the representation of interpretations, settings and situations, we are invoking a much more powerful mathematical apparatus than we actually need. Representing the interpretations,

etc. as sets of vectors from \underline{G}^1 would have been more appropriate in terms of the mathematical structure we are seeking; however, the two dimensional representation that we obtain with matrices provides us with an intuitive pictorial form for exhibiting abstract situations, and I have therefore chosen to use it here.

Properties of $*$ that we shall check are its associativity, commutativity, and the existence of an identity element. Thus $(\underline{G}, *)$, like $(\underline{G}^1, *_R)$, is a commutative semigroup with identity.

ASSOCIATIVITY: Let us adopt the convention that $(\underline{g} * \underline{h})_{\langle \underline{i}, \underline{j} \rangle}$ means the n th row of $(\underline{g} * \underline{h})$, where $\langle \underline{i}, \underline{j} \rangle$ is the n th pair in the enumeration. The associativity of $*$ can be demonstrated as follows. For fixed \underline{n} , let $\langle \underline{i}, \underline{j} \rangle$ be the n th member of the enumeration of pairs.

$$\begin{aligned} & ((\underline{g} * \underline{h}) * \underline{k})_{\underline{n}} \\ &= (\underline{g} * \underline{h})_{\underline{i}} *_R \underline{k}_{\underline{j}} \\ &= (\underline{g}_{\underline{p}_1(\underline{i})} *_R \underline{h}_{\underline{p}_2(\underline{i})}) *_R \underline{k}_{\underline{j}} \\ &= \underline{g}_{\underline{p}_1(\underline{i})} *_R (\underline{h}_{\underline{p}_2(\underline{i})} *_R \underline{k}_{\underline{j}}) \\ &= \underline{g}_{\underline{p}_1(\underline{i})} *_R (\underline{h} * \underline{k})_{\langle \underline{p}_2(\underline{i}), \underline{j} \rangle} \\ &= (\underline{g} * (\underline{h} * \underline{k}))_{\underline{m}} \end{aligned}$$

where $\underline{m} = \langle \underline{p}_1(\underline{i}), \langle \underline{p}_2(\underline{i}), \underline{j} \rangle \rangle$.

Now \underline{m} is uniquely defined, given \underline{n} , and as \underline{n} takes in succession the values 1, 2, ..., so \underline{m} ranges over all the natural numbers, and the mapping from \underline{n} to \underline{m} is a permutation. These properties follow from our adoption of diagonalisation for enumeration of all pairs. We have shown, therefore, that the matrix $\underline{g} * (\underline{h} * \underline{k})$ is obtained by permuting the rows of $(\underline{g} * \underline{h}) * \underline{k}$, hence that $(\underline{g} * \underline{h}) * \underline{k} \equiv \underline{g} * (\underline{h} * \underline{k}) \pmod{\mathcal{Q}}$, and thus that the operation $*$ is associative on \underline{G} when factored through the equivalence relation.

COMMUTATIVITY: We require

$$\underline{g} * \underline{h} = \underline{h} * \underline{g}$$

This follows easily from the properties of the enumeration: each row

of the left hand side is identical to one row of the matrix on the right hand side. Again let $\langle \underline{i}, \underline{j} \rangle$ be the n th pair of the enumeration:

$$\begin{aligned} & (\underline{g} * \underline{h})_{\underline{i}} \\ &= \underline{g}_{\underline{i}} *_{\mathbb{R}} \underline{h}_{\underline{j}} \\ &= \underline{h}_{\underline{j}} *_{\mathbb{R}} \underline{g}_{\underline{i}} \\ &= (\underline{h} * \underline{g})_{\langle \underline{j}, \underline{i} \rangle} \end{aligned}$$

and so $\underline{g} * \underline{h}$ is equivalent to $\underline{h} * \underline{g}$, and $*$ is commutative when factored through the equivalence relation.

IDENTITY ELEMENT: We must show that there is an element $1 \in \underline{G}$ such that

$$\underline{g} * 1 = \underline{g} = 1 * \underline{g}$$

The element 1 is simply the matrix containing only 0's: $1_{\underline{i}\underline{j}} = 0$ for all $\underline{i}, \underline{j} \in \omega$. Since we have just shown that $*$ is commutative, we need only show that $\underline{g} * 1 = \underline{g}$. Again, let $\langle \underline{i}, \underline{j} \rangle$ be the n th pair of the enumeration:

$$\begin{aligned} & (\underline{g} * 1)_{\underline{n}} \\ &= \underline{g}_{\underline{i}} *_{\mathbb{R}} 1_{\underline{j}} \\ &= \underline{g}_{\underline{i}} \end{aligned}$$

and so each row of $\underline{g} * 1$ is identical to one of \underline{g} and vice versa.

Finally, I want to point out which members of \underline{G} we are interested in from the semantic point of view. It is simplest to describe first those elements of \underline{G} which represent situations. An element $\underline{g} \in \underline{G}$ corresponds to an abstract situation if for each row $\underline{g}_{\underline{i}}$ of \underline{g} , $\underline{g}_{\underline{i}}$ is either a row of 0's or the following conditions are met:

$$\begin{aligned} \underline{g}_{i1} &= \underline{1} \\ \underline{g}_{i2} &= 1 \text{ or } -1 \\ \underline{g}_{i3} &= \underline{r} \in \mathbb{R}^n \text{ for some } \underline{n} \\ \underline{g}_{ij} &= \underline{a}_j \in \mathbb{A} \quad (4 < j \leq n+3) \end{aligned}$$

$$g_{ij} = 0 \text{ (} j > n+3 \text{)}$$

In particular, if for any i, j , $g_{ij} = 1$, g fails to represent a situation.

Settings and interpretations are represented by elements of G which correspond to situations with "holes". A hole is just a 0 where there should be an individual, a relation, a location or a truth value. There are, however, restrictions on where holes can occur, originating with the syntax of the object language. Within the framework defined by Aliass,

$$\begin{pmatrix} 1 & 0 & r^2 & 0 & b & 0 & 0 & \dots \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \dots \\ & & & & & & \ddots & \\ & & & & & & \ddots & \\ & & & & & & \ddots & \end{pmatrix}$$

is not a setting, since no expression of Aliass has an interpretation consisting of both an individual and a truth value. Nor is the matrix exhibited above an interpretation. Discovering which positions can contain holes so that a matrix is either an interpretation or a setting within the framework of either English or a version of Aliass that displayed an interesting range of grammatical constructions would be an interesting task, but not one that shall be pursued here.

* I am indebted to Charles McCarty for helpful criticism of earlier versions and a number of suggestions, from which this appendix has benefited greatly.

Notes to Chapter One

- ¹ This claim is made explicitly by Dummett:

A theory of meaning is a theory of understanding; that is, what a theory of meaning has to give an account of is what it is that someone knows when he knows the language, that is, when he knows the meanings of the expressions and sentences of the language. (Dummett, 1975, p. 99)

[...] philosophical questions about meaning are best interpreted as questions about understanding: a dictum about what the meaning of an expression consists in must be construed as a thesis about what it is to know its meaning. (Dummett, 1976, p. 69)

- ² See Hintikka (1962) and van Fraassen (1971).

³ In Barwise and Perry (1980) the authors set up the correspondence between sets of possible worlds and situation types, and so make no reference to locations. Nonetheless, it seems to me that if the aim were seriously to attempt a reconstruction of situation semantics within the possible worlds framework, the latter would have to be extended to include locations, and that the correct correlation is between sets of possible worlds and situations.

⁴ We do not have to admit all possible valuations -- we can choose which ones we want in fixing what the semantics is to be. Hence VL is to be the set of admissible valuations. In particular, since the definition is very general and embraces many "uninteresting" languages, one restriction we would want to place on a valuation v for it to be an admissible valuation for a language L, is that the truth value that v assigns to molecular sentences such as A & B should be a function of the truth values assigned to the constituent sentences A and B:

$$v(A \& B) = T \text{ iff } v(A) = v(B) = T$$

In fact van Fraassen's definition of a valuation is so general that it includes functions which assign entities other than 1 and 0 to sentences (van Fraassen, 1971, p. 31).

⁵ See van Fraassen (1971), p. 95. Van Fraassen remarks that a supervaluation for L is in general not an admissible valuation for L. In the context of a tradition of total interpretations and bivalent logics, admitting partiality by studying a language for which the admissible valuations include partial valuations is not much considered.

⁶ S&A, in the preface, page x.

⁷ Dretske takes de re informational content to be basic. He also considers that de re beliefs and knowledge are more fundamental than their de dicto counterparts, and that de re attitudes can be explained in terms of his theory of a signal's de re informational content. See Dretske (1981), pp. 66-68.

⁸ Strictly, it is the sequence of relation and individuals that is the constituent of a situation $\langle \underline{l}, \langle \underline{r}^n, a_1, \dots, a_n \rangle, \underline{i} \rangle$; individuals themselves are not constituents, but this loose expression of the matter does not affect our point here. I shall at times speak of individuals as constituents of situations. Cf. chapter five, note 5.

⁹ A version of innocence -- proto-innocence we might call it -- is found in the writing of Gilbert Ryle:

We do not and cannot describe haystacks in terms of this or that set of sensations. We describe our sensations by certain sorts of references to observers and things like haystacks. (Ryle, 1949, p. 193)

¹⁰ Actually, since these expressions belong to our language, we should not fault the ancient Egyptians for lack of this knowledge. Rather, what they failed to realise (to discover), in Fregean terms, was that the object presented by the sense of our expression 'the

Morning Star' (for which they had their own expression) is identical to the object presented by the sense of our expression 'the Evening Star' (for which, again, they had their own expression).

¹¹ The question is treated in chapter two.

¹² The distinction between ecological information and linguistic information that I am trying to draw is perhaps the same as the distinction recently made by some ecological psychologists between specificational and indicational information (see Turvey and Kugler, 1984). An example of linguistic information would be the information that a is E, while specificational information is, following the ecological psychologists, the kind of information that an organism picks up during perception. It is extremely difficult, if not impossible, to articulate all of this information in language; it is more susceptible to mathematical description, but even then the problem is still formidable.

The distinction also seems to be related to Dretske's distinction between information in analog and in digital form (Dretske, 1981, pp. 136-139).

¹³ In the non-sentential case the interpretations may be considered not parts of situations, but uniformities across situations.

¹⁴ The tension that arises because the two conceptions of information are being forced together is a symptom of an underlying malaise, of a fundamental problem at the heart of the semantics, for Barwise and Perry's assimilation of linguistic meaning, which is conventional, and linguistic information to meaning and information conceived ecologically -- natural meaning and specificational information -- is, I believe, just not possible. It is the root cause of many of the problems they face; it is that point at which I believe they take the wrong turning on the road to constructing a theory of meaning for the ecological approach. Is it really possible to treat the linguistic, conventional case analogously to the natural one? I do not think so. The real theory of meaning implicit in

ecological realism will require a lot more effort to work out and may well look very different from situation semantics.

Notes to Chapter Two

¹ More recent work in the philosophy of language from this perspective is that of Schiffer (1972) and Loar (1981).

² Thus: 'We treat [the distinction between a transparent and an opaque reading] as a scope distinction involving singular terms and formula modifiers, a distinction exemplified by the different relative scopes of his mother and willingly in (134) and (135). Since it is reflected at the level of logical form, we say that it is a semantic distinction. In contrast, the difference between definite and attributive reference is a pragmatic distinction, which is to say that it is not reflected in logical form.' (Richards, 1976, p. 359)

Richards considers the sentence

(132) Oedipus willingly married his mother.

The expression his mother can be understood as having either narrow or wide scope, which Richards represents respectively as:

(134) $\underline{o}_x (\int_x \underline{m}_y \underline{Wxy})$

(135) $\underline{o}_x \underline{m}_y (\int_x \underline{Wxy})$

where 'o' stands for Oedipus, '∫_x' for willingly, 'm' for his mother and 'W' for married.

³ We have already considered such a correspondence in chapter one, section (1.2.1).

⁴ The issue of a semantic role for information is taken up again in chapter seven.

⁵ Note that $[[\beta]]$ does not have its "standard" meaning as used here by Barwise and Perry. They write $\underline{d}, \underline{c} [[\beta]] \underline{a}_\sigma, \underline{e}$, whereas I would prefer to write $\underline{d}, \underline{c} [[\beta]] \sigma, \underline{e}$, with $\underline{e}/\sigma = \underline{a}_\sigma$. For a detailed

statement of this point, see chapter three.

⁶ In the text, to avoid too much confusion, I have employed Barwise and Perry's non-standard notation for the meaning of names; I would prefer to write: 'Jim' refers to j iff $\underline{d}, \underline{c} / [\text{Jim}] \sigma, \underline{e}$ and $\underline{e} / \sigma = \underline{j}$ (see chapter three).

⁷ Barwise and Perry raise this question in S&A, and point out that the name chosen affects the information conveyed, and that an innocent theory need not overlook this (p. 264). However, they miss the point, which is whether information has a semantic role.

⁸ Again Barwise and Perry are using meaning -- in this case the meaning of the description $[\tau]$ -- in a non-standard manner.

⁹ Note that in situation semantics, on the definition of truth that Barwise and Perry give us, viz.

$$\mathcal{M} \models_{\underline{d}, \underline{c}} \varphi \text{ iff } (\exists \underline{e}) (\underline{e} \in \mathcal{M}_0 \cap \underline{d}, \underline{c} ([\varphi])),$$

bivalence holds; a sentence uttered in a discourse situation \underline{d} with speaker connections \underline{c} is false if it is not true.

¹⁰ The status of Donnellan's referential/attributional distinction (is it semantic or pragmatic?) has been the subject of debate. Donnellan himself is not altogether clear on the matter: there is a difficulty in just what "the statement" is when the referent does not satisfy the description, but is drawn to the conclusion that the speaker 'may have stated something true or false' (Donnellan, 1966, p. 64). Kripke (1979) expresses disagreement with Donnellan's preference for a semantic ambiguity. Kripke distinguishes speaker's reference from semantic reference and believes that 'the problems Donnellan handles by semantic ambiguity should instead be treated by a general theory of speech acts'. (Kripke, 1979, p. 22)

¹¹ Barwise and Perry's adherence to the view that the referent must satisfy the conditions in the resource situation may be called in

question because of this lack of symmetry. Their adherence is motivated by their general theory of descriptions: there must always be some situation in which the referent satisfies the conditions associated with the description: for attributive uses, it is the described situation, for referential uses it is the resource situation. The only way to preserve this feature of their general theory and restore the symmetry with names would be to say that the resource situation for the referential case is not the one that the speaker thinks, but a similar one which differs minimally and where the referent does possess the requisite properties.

¹² This does not contradict the principle that Dretske espouses, that information is always veridical, that misinformation is not information.

¹³ We should not respond to this difficulty by analysing the sentence differently, as 'I am called "Jim"', which would at least be clearly false; for then we would be committed to this analysis each time a sentence containing a name is uttered, including those cases when it is uttered truly. This is contrary to almost everything Barwise and Perry say about names: when Lee says 'I'm Lee', he has not mentioned his name, and so on.

Notes to Chapter Three

¹ This step of associating individuals with a name simpliciter is taken in Aliass despite the belief that it is a mistake; it helps to simplify the semantics of Aliass by going against the view of the main text on a point that is not crucial for Aliass, which is mainly concerned with showing how the semantics works out with regard to the issue of compositionality and related issues, such as pronominal anaphora. Barwise and Perry pointed out in the main text that names do not uniquely identify individuals: in the general case, many individuals have the same name at any one time, so that more needs to be said on the semantics of names than we are told in the appendices on Aliass.

² However, in Singular Aliass sentences can have event indeterminates e_1 or e_0 in their SCat, but these must be discharged when the sentence is used to make a statement. The indeterminate e_1 is moved to $AF(\varphi)$, φ a sentence, by rule S4, and e_0 is moved to $RS(\alpha)$, α an expression of any category, by the resource situation rule. (See S&A, pp. 313,316.)

³ The rule (b) in full is:

NP2: If α is an NP with assigned semantic features, and x_i is a variable, then x_i can be added to the AF of α . The SCat and Tense of α are unchanged. We represent the expression with its new semantic features by α_i . The meaning of the NP with its new associated features is

$$\begin{aligned} & d, c \llbracket \alpha_i \rrbracket \sigma, e \\ & \text{iff } d, c \llbracket \alpha \rrbracket \sigma, e \text{ and if } c(x_i) \text{ is defined, then } c(x_i) = \\ & \underline{a}_\sigma. \end{aligned}$$

Strictly, there is a slight difference between the meaning of the NP and that of the IT, since there is the condition that $c(x_i) = a_\sigma$. However, this is not relevant to the concerns of the text. Considered extensionally, the meaning of the NP is a subset of the meaning of the IT, for those quadruples $\langle d, c, \sigma, e \rangle$ where $c(x_i) \neq a_\sigma$ are filtered out. But the possible referents are the same: the referential "reach" is the same.

⁴ Notably, the situation itself is not a real but an abstract entity; however, this is not the issue just at the moment.

I use 'components' to refer to all the entities that are used to construct abstract situations, the term 'constituents' being reserved for those which are set theoretic members of abstract situations. Thus, the constituents of the abstract situation $\langle l, \langle r, a, b \rangle, 1 \rangle$ are l , the sequence $\langle r, a, b \rangle$, and 1, but its components are l , r , a , b , and 1. The distinction may be thought of in terms of ultimate constituents and immediate constituents.

⁵ In a more recent version of the theory than occurs in Barwise and Perry (1983), a distinction is made between located and unlocated situations. More precisely, an abstract located circumstance is a sequence of the form $\langle l, r, x_1, \dots, x_n, \text{pol} \rangle$, and an abstract unlocated circumstance is a sequence $\langle r, x_1, \dots, x_n, \text{pol} \rangle$, where l is a location, r an n -ary relation, the x_j ($j = 1, \dots, n$) individuals, and $\text{pol} \in \{0, 1\}$. See Barwise (1984).

⁶ This latter conception of the interpretation of a relation symbol is the one adopted when the theory is formulated rigorously so that it can serve as the semantic component to a formal generative grammar. Thus, Robin Cooper, who has spent much of the spring and summer of 1984 working on ELIUSS represents the interpretations of relation symbols in this way (cf. note 23 and chapter five).

⁷ There is a problem with NPs in the semantics in Aliass. For an NP α , the relevant indeterminate is a ; but if the NP is in object position, the really important indeterminate is b . See section

(3.3.2) below for a discussion of this issue, which I have called the Object NP Problem.

⁸ The rationals would also be available to us if we wanted them, but the reals are a different matter, given the constructive nature of the underlying set theory, KPU. If we use Dedekind cuts to define them, we are dealing with classes of rationals, which cannot be parts of situations.

⁹ Strictly, there is provision in Aliass only for one- or two-place predicates (relation symbols). I shall sometimes proceed as if this were already generalised to n-place predicates, for arbitrary n.

¹⁰ The general problem of this section is not so acute in a first order language for the predicate calculus. Usually the atomic sentences are just composed of an n-place predicate followed by n terms, for variable n. Terms, simple and complex, designate individuals, sentences designate a truth value (and, supposing we are dealing with an extensional language, the truth value of a molecular sentence is a function of the truth values of its parts), so the only possible problem would come from the references of the predicates. These are usually taken to be sets of individuals. We can ask whether these sets are parts of the world, or correspond to anything in the world, or whether they are just artifacts of the theory. The answer is that the extension assigned to a predicate P is just the set of all individuals that have the property associated with P. In a theory founded on an ontology which sees only individuals in the world, and not properties, classification of individuals under certain predicates is the action of a cognitive agent, so there would not be something in the world independent of the agent. However, there is something outside the theory -- the agent's classificatory activity -- that the set is intended to represent. In any case, predicates are themselves basic expressions, not members of a compound, intermediate category.

¹¹ The independence of the primitives and of meaning, for both

lexical and therefore compound expressions, from the situation structure is an important distinction between the two theories. Of course, we could expand the role of the situation structure in situation semantics to include not just which subclass M_0 of the class of all situations \mathcal{E} is to be the class of actual situations in \mathcal{M} , but also the definition of \mathcal{E} itself, via setting out which are to be the classes A of individuals, R of relations and L of locations for the situation structure \mathcal{M} , and to include also the definition of the meanings of the basic expressions (and via these, because of the compositionality of meaning, of compound expressions). Barwise and Perry, however, take the primitives as fixed and meaning as independent of the situation structure. Their reason for doing so is probably to distance themselves from possible world semantics by fixing the individuals that there are in the world:

We do not believe that there are other possible worlds in the sense demanded of them by this theory, only other ways this world of ours might have been and might be.
(S&A, p. xiii)

They distance themselves by fixing meaning too.

¹² In this section I shall talk of sets when strictly I should sometimes say classes. To place this talk on firm ground, I would need to use a different set theory from Barwise and Perry, but we gain in not having to make the, at times, tedious distinction between set and (proper) class.

¹³ Compare this result with the similar one obtained with respect to the semantics for necessity and possibility in chapter six, section (6.2.2).

¹⁴ This is a slight, but unimportant modification to the formulations of the meaning of tensed VPs as found both in the main text of S&A, (p. 129) and in the appendix on Aliass (p. 303). Notice that σ itself is not the individual required; rather it is a function which provides the individual.

¹⁵ John McDowell has argued for this explicitly in McDowell (1978). McDowell distinguishes the level at which language contacts the world within semantic theory (at the level of the axioms of a Tarskian truth theory) from the level at which language actually "hooks up to" the world (at the level of sentences). See the discussion of McDowell's article in chapter two, section (2.1.1).

¹⁶ Cf. S&A, pp. 128,129. Note that for Barwise and Perry the third relatum is the individual, not the setting. More on this below.

¹⁷ The operation "plus" is not specified exactly at this point; clearly it will have a lot in common with the way the constituents of an abstract situation are held together in that situation. The reader is asked to think of the operation intuitively for the present; more is revealed below, and a detailed exposition of the operation is given in the appendix.

¹⁸ I say tentatively because of the assumption that meaning can be represented in this set-theoretic way.

¹⁹ The reader should not be worried that the operation $*$ is defined over individuals as well as settings; when explicated below, it is intended to apply to all the pieces that can be put together in the construction of abstract situations. However, see the following note.

²⁰ For a rigorous treatment of these matters, see the appendix. Here I shall remark that just as courses of events need to be regarded as matrices, so too individuals, relations and locations x will need to be transformed to matrices $[x]$ before $*$ can operate on them.

²¹ I ignore any difficulty there may be in representing in the matrix notation situations which specify an uncountably infinite number of relations to hold: KPU set theory does admit infinite entities as sets, therefore these situations are possible (Barwise,

1975). These set theoretic entities, of course, are not capable of being exhibited in Barwise and Perry's informal notation either.

²² The matrix notation is helpful in displaying the similarities.

²³ Robin Cooper, however, does show us what the interpretations of the entities which assume this role (verbs or predicates) look like. I discuss his work in chapter five; for the present suffice it to say that his interpretation for a relation symbol \mathcal{R} is $\langle \underline{m}(\mathcal{R}), s, o, 1 \rangle$, where $\underline{m}(\mathcal{R})$ is the relation denoted by the relation symbol.

²⁴ I am grateful to Mark Gawron for pointing out this problem, and to the informal group on situation semantics at the School of Epistemics for discussion about it.

²⁵ The problem is more general than this, for we consider only direct objects. If one considered verbs which take an indirect object in addition to the subject and direct object, the problem is multiplied, for now three NPs have to be correlated.

²⁶ Indeed, this is their opinion. Robin Cooper speaks of 'Barwise and Perry's view of syntax as part of the utterance situation' (abstract of a seminar, as printed in the CSLI NEWSLETTER, August 2, 1984).

Notes to Chapter Four

¹ Russell gives as an example of a particular fact: that this is white (holding up a piece of chalk); as is well known, Socrates would not have been a particular for Russell, and hence the fact that Socrates is mortal is a complex fact for him. However, we need not follow Russell on this point; we can accept the basic idea he is presenting without supposing that the particulars which the view refers to are sense data rather than individual objects as we normally think of them. The causal theory of reference (Kripke, 1971, 1972) would support this course, for it teaches that the name 'Socrates' refers causally to Socrates as an individual, and if one accepts the existence of singular propositions, the individual enters into the proposition expressed by a sentence containing the name, rather than the proposition having the more complex structure the descriptive theory of names accords to it. I have therefore chosen Socrates' mortality as a suitable candidate for a particular fact, being appropriate for contrasting with the mortality of all mankind, the exemplar of a general fact.

² See Russell (1956), p. 209 for a statement about disjunction and pp. 211-214 for a discussion of negative facts.

³ Russell's reasoning here, as in other places, bears traces of his early affinity with G. E. Moore. The latter, as has already been remarked, once identified true proposition and reality -- proposition and fact. False propositions proved problematic for this idea; false beliefs proved problematic for propositions. John Passmore summarises the point very well:

The case of the false belief led Moore to this conclusion. On the propositional theory, there must be a proposition for us falsely to believe in, even although this proposition has the peculiar property of being false. In fact, however, so Moore argues, it is the very essence of a false belief that we believe what is not. As Russell put the same point in The Problems of

Philosophy (1912), when Othello falsely believes that Desdemona loves Cassio his belief is false just because there is no such object as Desdemona loves Cassio; if there were such an object, as on the propositional theory there has to be, Othello's belief would be true, not false. Once we come to realize that a false belief is not a belief in a proposition, it seems natural to deny, also -- or so both Moore and Russell thought -- that a true belief has a proposition as its object. 'Belief', so Moore sums the matter up, 'never consists in a relation between ourselves and something else (the proposition) which is believed.' In fact, 'there are no propositions'. (Passmore, 1966, pp. 205,206)

⁴ For statements of their position on this point, see Barwise (1981), p. 389; Barwise and Perry (1981b), pp. 668,669; and S&A, pp. 7,8.

⁵ I am ignoring details that complicate the picture here, such as anaphoric pronouns, which involve constraints on the references of expressions in the subsentences of both conjunctive and disjunctive compound sentences. See S&A, pp. 136-138. Cf. chapter eight, note 3.

⁶ Interesting! Do we have an intuitionist strand to the underlying logic of situation semantics? Robin Cooper's extension of the theory, to be discussed in the next chapter, does allow situations (facts, as he calls them) like $\langle \text{or}, \underline{f}, \underline{g}, 1 \rangle$, which regains the symmetry between conjunction and disjunction, but he retains this putative intuitionist strand, since he imposes structural constraints which require either \underline{f} or \underline{g} to be in actual situations containing the disjunctive fact $\langle \text{or}, \underline{f}, \underline{g}, 1 \rangle$.

⁷ More recently still the word 'proposition' has begun to be used for these objects, which Barwise calls circumstances (CSLI NEWSLETTER, October 4, 1984).

⁸ The more recent theory found in Barwise (1984) represents a return in spirit to realistic propositions without violating the 1983 metatheory, by making situation type the central notion of the

theory, rather than situation. The type of all the situations in a realistic proposition is a finite object, a set, and yet contains all the information in the realistic proposition.

⁹ In fact, a restriction of \mathcal{L} is needed, so the members of \mathcal{L} cannot quite be just anything. Prohibited from membership of \mathcal{L} are sequences y_1, \dots, y_n when y_i for some i between 1 and n inclusive is a primitive symbol (the primitive symbols for a language $L(P, \mathcal{V}, \mathcal{L})$ are: the sets $P, \mathcal{V}, \mathcal{L}$; the variables of the language; the punctuation, sentence connectives $\rightarrow, -, \text{ and } \forall$). See Richards (1974), p. 433.

¹⁰ This definition seems to be defective: what is meant in the second clause is surely that $\underline{S}^*(t)$ is the value of $\underline{V}(\underline{F})$ at $\langle \underline{S}^*(t_1), \dots, \underline{S}^*(t_n) \rangle$, to cover for the iterated case (ie. where t_i ($1 \leq i \leq n$) is itself a closed term, consisting of a function letter and a suitable number of closed terms.

¹¹ Richards does not follow Russell in allowing only sense data as individuals, of course. Russell would apparently have allowed these other singular propositions containing Socrates, etc. as propositions, only he would have said that we cannot grasp them (cf. Russell, 1956, p. 56).

¹² I am using the exclamation mark in the quantifier ' $\exists!x$ ' to abbreviate the uniqueness condition, as spelled out according to Russell's (1905) analysis.

¹³ This situation too has changed with the more recent versions of the theory, eg. Barwise (1984). The use of situation types permits general propositions to be represented directly by a type. The general proposition $\exists!x \underline{F}x$ is the type of situations in which a unique thing is \underline{F} ; the general proposition $\forall x \underline{F}x$ is the type of situations in which all things are \underline{F} .

¹⁴ This avenue will be explored in the next chapter, following up

Robin Cooper's ideas on extending the theory. Cf. the preceding note.

Notes to Chapter Five

¹ I wish to acknowledge my gratitude to Mary Tait and Barry Richards for making suggestions which led to the writing of this section.

² Although in Barwise and Perry (1981b) the authors still consider that there is a world, in that paper they display how they think of and work with the internal structure of situations; they have already made at this stage the transition to abstract situations as the interpretations of utterances.

³ Cf. also the discussion of false propositions in connection with Russell in chapter four, as a reason why real situations cannot retain a semantic role.

⁴ See Goldblatt (1984), pp. 14-16.

⁵ Strictly, the location is the only constituent of abstract situations that is in the world; individuals and properties are not constituents of abstract situations, only the constituents sequence of property and individuals is a constituent, and this sequence is not in the world. However, this is beside the point in the text, since we could reformulate the representation of abstract situations, changing

$$\langle \underline{l}, \langle \underline{r}^n, \underline{a}_1, \dots, \underline{a}_n \rangle, \underline{i} \rangle$$

to

$$\langle \underline{l}, \underline{r}^n, \underline{a}_1, \dots, \underline{a}_n, \underline{i} \rangle$$

thus making individuals, properties, and locations each constituents. Sometimes I shall speak of components of an abstract situation, meaning individuals and properties are components of abstract

situations as currently represented.

⁶ In Kaplan (1975), which we shall consider in the following chapter, Kaplan says, prior to his examination of the position of the two theories -- Russell's and Frege's -- with respect to haecceitism,

When we construct a model of something, we must distinguish those features of the model which represent features of that which we model, from features which are intrinsic to the model and play no representational role. The latter are artifacts of the model. (Kaplan, 1975, p. 722)

We are presently applying this advice to the nature or role of the set theory in situation semantics.

⁷ We have said nothing thus far to prevent formation of the sentence $\underline{S} \ \& \ \underline{S}$, which, as a sentence, is of course distinct from \underline{S} itself. If \underline{S} corresponds to the abstract situation \underline{e} , then $\underline{S} \ \& \ \underline{S}$ corresponds to $\underline{e} \cup \underline{e} = \underline{e}$. Hence we do not have an isomorphism from sentences of L to abstract situations, but a many-one mapping. One response to this problem is to regard $\&$ as associative: $(\underline{S} \ \& \ \underline{S}') \ \& \ \underline{S}''$ is the same sentence as $\underline{S} \ \& \ (\underline{S}' \ \& \ \underline{S}'')$, and to define the correspondence between L and abstract situations not in terms of sentences, but of equivalence classes of sentences, as generated by an equivalence relation based on a notion of reduction of one sentence to another. Intuitively, one sentence reduces to another by elimination of contained copies of atomic sentences. Thus, using φ , ψ and ω as variables over molecular sentences and \underline{S} as an atomic sentence, a sentence of the form $\varphi \ \& \ \underline{S} \ \& \ \psi \ \& \ \underline{S} \ \& \ \omega$ reduces to $\varphi \ \& \ \underline{S} \ \& \ \psi \ \& \ \omega$. The equivalence relation is then defined by: for any two sentences \underline{S} and \underline{S}' , $\underline{S} \equiv \underline{S}'$ if either \underline{S} reduces to \underline{S}' or \underline{S}' reduces to \underline{S} .

An alternative response is not to be worried by the problem, since if situation semantics is extended along the lines suggested by Robin Cooper (see section 5.3), there will be a situation corresponding to the sentence $\underline{S} \ \& \ \underline{S}$, namely

{<and, f_S , f_S , 1>}

⁸ Barry Richards pointed out to me that the disjointness condition in the sets \mathcal{A} , \mathcal{R} and \mathcal{Z} needs to be stated.

⁹ Provision is therefore made for relation variables (relation indeterminates), although, as with Barwise and Perry in situation semantics, we shall not be concerned with them after the definition.

¹⁰ Another legacy of Russell: compare this with Richards' understanding of Russellian propositions in terms of an object ω -ing:

If u utters $\omega(Ix\Phi x)$ and t and $Ix\Phi x$ does not occur inside a modal context, then if $(-c_1)$, (c_2) and (c_3) obtain then $\omega(Ix\Phi x)$ at $\langle u, t \rangle$ expresses the proposition that there is exactly one Φ and it ω 's.

¹¹ At the end of chapter nine of S&A (pp. 220-223), Barwise and Perry give four reasons for the failure of the idea that attitudes are relations to situations; the reasons come under the headings: Folk Psychology; Missing the Mental; Capturing the Constraints; and Foundational Problems.

¹² Sometimes Barwise and Perry have B_x relate the agent directly to E , particularly when, as here, there is only one event type involved. This is just not bothering to write out the semantics in full. I shall adhere to the strict form of the semantics, and so in the example I have B_x relate John to $\underline{S} = \{ E \}$.

¹³ This state of affairs is due to a confused use of event types and schemata in abstract situations: briefly, abstract situations were originally supposed to represent real world relations between real world individuals; although we find relations like B_x holding among agents and schemata, the latter is not a piece of the world. For further discussion of this issue see chapter seven.

¹⁴ Rather than adopt Barwise and Perry's notation of bold characters (and a dot above the character) for indeterminates, I prefer to employ different letters of the alphabet as variables. Hence a, b, ... are elements of \mathcal{B} ; x, y, ... are individual variables; l is a location in \mathcal{L} ; h, k, are location variables; etc.

¹⁵ If the interpretation were, in the formalism introduced in chapter three, a suitable matrix [j] rather than Jackie, then interpretations would be dependent on the grammatical role of the expressions in object language sentences. Thus, the interpretation of 'Jackie' in

(1) Jackie is biting Molly.

would be

$$\begin{pmatrix} 0 & 0 & 0 & j & 0 & 0 & \dots \\ \cdot & \cdot & & & & & \\ \cdot & \cdot & & & & & \\ \cdot & \cdot & & & & & \end{pmatrix}$$

and the interpretation of 'Jackie' in

(2) Molly is biting Jackie.

would be

$$\begin{pmatrix} 0 & 0 & 0 & 0 & j & 0 & \dots \\ \cdot & \cdot & & & & & \\ \cdot & \cdot & & & & & \\ \cdot & \cdot & & & & & \end{pmatrix}$$

Of course, this makes explicit the fact that meaning is not language-independent.

¹⁶ There is no mention of facts of these kinds in the main text. Nonetheless, this move is forced by the introduction of conjunctive and disjunctive facts (and is needed in any case to justify his argument in the main text), not by any peculiarity of the formal language that Cooper defines in his appendix.

17 Anthony Kenny says in his book on Wittgenstein:

According to the Tractatus there must be something which any picture, of whatever kind, must have in common with what it depicts, if it is to be able to depict it even incorrectly. This irreducible minimum is called by Wittgenstein 'logical form'. (Kenny, 1973, p. 5)

Pictures can be more or less abstract, more or less like what they picture: their pictorial form can be more or less rich. But there is a minimum which must be common between reality and picture if the picture is to be able to portray even incorrectly: this minimum, Wittgenstein says, is logical form (TLP 2.18).¹ What this amounts to is that the elements of the picture must be capable of some combination with each other in a pattern corresponding to the relationship of the elements of what is pictured (cf. TLP 2.0141). (Kenny, 1973, p. 57)

18 Although I speak of 'the logical form' of a proposition, it is not correct to think of propositions as having a unique logical form; the representation of logical form in the predicate calculus will depend on how much structure is uncovered. Thus we may say that a proposition has the logical form $A \rightarrow B$, but uncovering more structure we realise that the more detailed logical form is, say, $\forall xFx \rightarrow \exists xFx$ (which is true in a nonempty domain).

19 There are one and a half pages on the matter in the final chapter of S&A (pp. 290-292) and a few lines in the appendix to chapter seven (p. 315).

20 This formulation of the semantics of general NPs follows Barwise and Perry (the 1983 theory), who prefer that notion of settings which is developed in the semantics for Aliass, which I have called the alternative conception of a setting. To reformulate the semantics of general NPs using the original conception of a setting would involve extensive revision, for example to the semantics of VPs, and I have therefore decided to retain Barwise and Perry's alternative conception in this section. The amount of revision required is less.

21 More precisely, following Barwise and Cooper (1981), 'some' is a

logical determiner, and 'some \underline{X} ', \underline{X} a set term, is a noun phrase, or equivalently, a quantifier. Nonetheless, I shall use the word 'quantifier' loosely for expressions such as 'some' in the sequel, since I do not follow Barwise and Cooper's strategy of having a quantifier Q designate a family of sets, a set term η designate a set, and where a sentence is true if the set designated by η is in the family designated by Q . [Continued below]

²² The condition $\underline{Y}_\sigma \subseteq \underline{X}_\sigma$ seems redundant; however, we must have $\underline{X} \in \text{SCat}(\text{no})$ so that the meaning and compositional rules can be defined for quantifiers generally.

²³ The treatment in Singular Aliass (S&A, Appendix to chapter seven) takes up Austin's suggestion, or rather supposition, that utterances are correlated with states of affairs by demonstrative conventions (Austin, 1961, pp. 121ff) and incorporates a situation indeterminate e_0 , which can be associated with a particular abstract situation $\underline{c}(e_0)$ that the speaker intends to refer to by the speaker connections.

²⁴ See Robin Cooper (1979). His translation of the indefinite article into Montague's intensional logic is $\lambda J \lambda K \lambda u [J(u) \ \& \ K(u)]$, so that 'a \underline{G} ' would translate as $\lambda K \lambda u [\underline{G}(u) \ \& \ K(u)]$, and the sentence 'a \underline{G} \underline{F} 's' would be $\neg u [\underline{G}(u) \ \& \ \underline{F}(u)]$.

21. (Cont.)

My treatment differs from Barwise and Cooper's in that the general NP designates a set of individuals (\underline{Y}_σ), not a family of sets. When the quantifier 'some' combines with the noun 'dog', \underline{X}_σ is constrained to be the set of dogs in the described situation, the set \underline{Y}_σ thereby being constrained to be some of these dogs (see rule (13) in the text). The situation \underline{e} in the meaning of the NP, $\underline{d}, \underline{c} [\text{some dog}] \sigma, \underline{e}$, is also functioning as a resource situation, determining exactly the set of dogs from which the some dogs will be chosen. This case is similar to the attributive use of definite descriptions, in that resource situation and described situation are identical.

Notes to Chapter Six

¹ From Kaplan (1978), p. 223. See Charles Taylor's review of Evans' book (Taylor, 1983) for an interpretation of Evans' work that views it as trying to break down the Cartesian distinction between subject and object, between thought and meanings on the one hand, and the world on the other.

² Some readers may consider the concept of haecceitism meaningful only when we already presuppose the possible worlds framework. Kaplan's definition:

The doctrine that holds that it does make sense to ask -- without reference to common attributes and behavior -- whether this is the same individual in another possible world, that individuals can be extended in logical space (ie. through possible worlds) in much the way we commonly regard them as being extended in physical space and time, and that a common "thisness" may underlie extreme dissimilarity or distinct thisnesses may underlie great resemblance, I call Haecceitism. (Kaplan, 1975, pp. 722-723)

makes reference to possible worlds and possible individuals in worlds. However, making sense of the notions of necessity and possibility, which we must do before we can provide a semantics for the modal operators 'necessarily' and 'possibly' of natural language, raises the question of haecceitism or anti-haecceitism. Even if one agrees with Barwise and Perry that there are no other possible worlds, only ways this world of ours might have been and might be, one is effectively entertaining alternative possible situations.

Actually, Kripke seems to reject the idea that there is a problem with "transworld identity": 'A possible world isn't a distant country that we are coming across, or viewing through a telescope. [...] 'Possible worlds' are stipulated, not discovered by powerful telescopes. There is no reason why we cannot stipulate that, in talking about what would have happened to Nixon in a certain

counterfactual situation, we are talking about what would have happened to him. (Kripke, 1980, p. 44)

³ Kaplan remarks on the qualifications to his analysis in section II of his paper, so I shall not say anything more about them.

⁴ So Kaplan claims. Barry Richards has pointed out in conversation that truth values are not actually part of the ontology, since they are not quantified over.

⁵ I have not included basic indeterminates in the ontology of situation semantics for two reasons. Firstly, they are not regarded as things in the world. Secondly, and more importantly, although they are urelements of the set theory as formulated in S&A, they need not be in other representations of situation semantics; as Barwise and Perry point out, situation types could alternatively be constructed as equivalence classes of situations (S&A, p. 71).

⁶ I shall often speak of properties, when more precisely I mean intensional relations -- relations in the world as understood in situation semantics; properties, which are usually understood as one-place intensional relations, are being taken as representative of intensional relations in general. Understanding properties in this sense means that we do not constantly have to distinguish between the intensional and extensional senses of relations.

⁷ The exact, formal, set theoretic representation of situations varies. In the book Barwise and Perry write:

state of affairs = $\langle \underline{l}, \underline{s} \rangle = \langle \underline{l}, \{ \langle \underline{r}, \underline{a}_1, \dots, \underline{a}_n \rangle, 1 \rangle, \dots \} \rangle$ (pp. 53, 54)

course of events = $\{ \langle \underline{l}, \underline{y}, \underline{i} \rangle, \langle \underline{l}', \underline{y}', \underline{i}' \rangle, \dots \}$ (p. 56)

where the \underline{y} are constituent sequences. Consequently, a situation is not equal to the set theoretic union of the singleton of all the states of affairs it makes reference to, or contains. They also think of situations as partial functions (Barwise and Perry, 1981b,

p. 669; S&A, p. 56). I shall generally employ the representation of situations as sets of triples $\langle l, y, i \rangle$, where y is a constituent sequence.

⁸ 'We regard truth values as slipping into the universe in the process of abstraction from situations to objects standing or not standing in relations.' From Barwise and Perry (1981b) p. 669, footnote.

⁹ For an account of this shift, see chapter five, section 5.1.1.

¹⁰ The propositions I refer to are those expressed by utterances of these sentences for which the speaker connections determine Jackie and Molly, ie. a particular Jackie (Barwise's dog) and a particular Molly (Perry's dog).

¹¹ Cf. the treatment of partiality in chapter eight.

¹² Of course, in doing so we are brushing aside all the meta-theory of situation semantics: ecological realism and the view that properties are real constituents of the world. Kaplan does the same with respect to Russell's and Frege's meta-theoretical views.

¹³ This point particularly strikes the reader of the appendices to S&A where Aliass is defined. The meanings of expressions are fundamental: at each compositional stage, it is the meaning of the compound expression that is defined, and this is done in terms of the meanings of the parts.

¹⁴ I am grateful to Ewan Klein, who, when confronted with the possible worlds proposal, suggested to me the use of possible options as a method for adding necessity and possibility to situation semantics.

¹⁵ More explicitly, it is a sextuple $\langle A, R, L, M_0, \mathcal{M}, R \rangle$, but I omit the first three entities, since Barwise and Perry omit mention of

them in their definition (S&A, p. 60). Yet it seems to me that we should not forget these classes in defining the model: specification of the domain is an integral part of the traditional definition in model theory. Perhaps Barwise and Perry are again rebelling against the tradition for being so abstracted from the real world -- they think that A, R, and L are given to us in reality, so that we do not need to specify them.

¹⁶ Perhaps the reason why we find it much easier to accept that various singular terms designate a single individual (rather than several "individuals") than to accept that there should be canonical properties in the world with several natural language verbs denoting one property, is because of how we conceive the world to be: individuals are very concrete inhabitants of it, whereas properties are rarefied inhabitants which appear and disappear (if they exist in the universe at all).

¹⁷ Of course, 'moves' does not mean exactly the same thing as 'orbits'; but in the context in which it is uttered here, let us grant that the meaning is essentially the same in the two cases, and hence the pragmatic component might regard them as deserving to be assigned the same predicate G of L.

¹⁸ This point has been made with respect to situation semantics by Robin Cooper. His remark is found in Cooper (1983), p. 2.

¹⁹ Almog states in the preface to Almog (1983) that he does not consider all the variants of Neo-Fregeanism; in particular, he does not deal with the Evans-Peacocke theory, but hopes to rectify this in a later version. Compare the remark in the text with my discussion of what I call the Evans-McDowell version of Fregean theory in the next chapter (section 7.1.2).

²⁰ Michael Devitt (1974, 1981) importantly points out that a name can be multiply grounded: thus Devitt on his family's pet cat Nana:

Nana is involved in the causal network for her name at more points than its beginning at her naming ceremony; the network is multiply grounded in her. (Devitt, 1981, p. 56)

When Devitt passes the ability to use 'Nana' as a name for the cat by uttering 'This is Nana' and pointing to the cat, the name is further grounded in Nana;

Nana will be both mediately and immediately causally involved in this passing on. She will be mediately involved via the ability I exercise in using her name, an ability grounded in her at the naming ceremony. She will be immediately involved because 'this' is a designational demonstrative: she is present at the utterance, and her presence leads to my use of the demonstrative. (Devitt, 1981, p. 56)

- 21 Almog is reluctant to speak in terms of possible worlds:

My belief is that as long as we leave "worlds" as some sort of primitives, we run the risk of reifying the problem of "trans-world-identification" all over again. My reasons are very general: ultimately, I would like to claim that possible worlds cannot be left as primitives even when we give a semantics to an object language with modal operators. Even then, I would like to claim, the modal idioms come first and we should treat them in terms of properties of propositions. (Almog, 1983, p. 45)

However, I shall continue to employ the possible worlds framework on occasions when it is convenient; we need to see how Almog intends to work without it before dropping it altogether. Nevertheless, we must use the idiom carefully: I share his dissatisfaction with the whole possible worlds framework.

- 22 Almog's paper, 'Sinnless Reference', is available to me at present only in draft form, and is not always explicit. In particular, there is no complete specification of his system. This is why there are points in my account of his view that may appear vague and where the reader may wish that I had been more explicit about Almog's system. For example, while some properties are taken to be basic (notably those deriving from natural kinds), others

presumably would not be. But it is not clear that for every sentence Fa , the property denoted by F must be either basic itself, or analysable or decomposable into other expressions, terms and predicates, that are basic, so that each singular proposition would contain at least one individual and at least one property. Almog does say, however, that he wants to extend the directly referential view from natural kind terms to all single-word-predicate expressions.

²³ Naturally, on the Fregean view, the proper names 'Achilles' and 'Priam' would themselves determine their referents via mediating senses, but I ignore this detail here in making the main point.

²⁴ It is worth noting that Wittgenstein held that the logical constants do not denote or represent. Although part of the proposition, they do not correspond to anything in the world, anything in the level pictured. Instead they indicate that operations have been performed upon elementary propositions (Wittgenstein, 1929).

²⁵ Actually, Almog does not explicitly say that these are all the constituents; he also speaks of the kind membership relation, but adding this in as a constituent still leaves us with a set of entities, not a proposition: Russell's ultimate notion of assertion is lacking. Because of this, it is not important for the point in question whether we consider the kind membership relation a constituent or not: if we do, the representation of the proposition will be $\langle e_K, \text{Bagheera, pantherhood, 1} \rangle$.

²⁶ Since I have not seen Almog's full system, I am only presuming that his propositional function maps the constituent propositions to a proposition. Another possibility is that the propositional function acts on the linguistic constituents.

Notes to Chapter Seven

¹ Barwise and Perry prefer to call these simply 'attitudinal contexts', thereby not committing themselves to regarding the attitudes as relations to propositions. In an interesting section in S&A (Shaken Attitudes, pp. 177-179) they comment on why they have dropped the adjective 'propositional'. Their reason is that propositions, if they are identified with the interpretations of utterances, are proper classes, and Barwise and Perry interpret this as implying that propositions are not a part of the causal order, since as proper classes, propositions cannot be elements of any set and thus are not part of any situation. This chain of reasoning inverts the proper relationship between the theory and what the theory is about. Barwise and Perry's conclusions about the role of propositions is based on a property of the theoretical representation of propositions. In fact, according to the 1984 theory, which assigns situation types to utterances as interpretations, propositions are sets and can be constituents of situations -- hence are perhaps part of the causal order.

² For those unfamiliar with Leibniz' Law, I cite the following formulation:

Given a true statement of identity, one of its two terms may be substituted for the other in any true statement and the result will be true. (Quine, 1953, p. 17)

³ Quine, in his article (Quine, 1956), draws a distinction between the relational and notional senses of belief. Stephen Stich questions the distinction between de re and de dicto belief. See his (1983), chapter six.

⁴ See Barwise and Perry's Maxim A (S&A, p. 288), cited above on p. 50.

⁵ This assumes a rather simplistic view of the speaker's motives -- that he is sincere and intends to communicate as fully and accurately as possible. In real situations, the speaker often has other motives, and we can safely say that the choice of expression is determined by the complex interaction of a number of factors.

⁶ Field (1977) gives a semantics for the predicate calculus based on the notion of subjective probability, a purely epistemic notion contrasting with the usual truth conditional semantics. Field argues that we should regard the probabilistic semantics as constituting a layer corresponding to Fregean sense on top of a truth conditional semantics, which would fix the referential meaning of expressions. Referential meaning does not distinguish the meanings of

Hesperus = Hesperus

Hesperus = Phosphorus

so Field claims that conceptual role, as explicated by the probabilistic semantics, must be a part of meaning and that these sentences differ in conceptual role. Meaning, therefore, has two components:

My view rather is that truth-theoretic semantics and conceptual-role semantics supplement each other: truth-theoretic semantics cannot account for certain differences in sense unaccompanied by differences in reference; and conceptual-role semantics, though it deals nicely with questions of intra-speaker synonymy, cannot properly answer questions about inter-speaker synonymy or about relation between language and the world. But, taken together, I claim, truth-theoretic semantics and conceptual-role semantics provide an account of all the facts about meaning that there are. (Field, 1977, p. 380)

⁷ McGinn (1982) also takes the view that there are two components to meaning, and indeed considers Field's ideas in (Field, 1972, 1978) 'close to the truth' (McGinn, 1982, p. 225). McGinn begins by asking what the notion of sentential meaning is designed to do, and replies that one influential and appealing answer is that it is tied to the

explanation of the use of language. The problem is that reference drops out of theories of meaning shaped by the idea that meaning is use (Putnam, 1978). McGinn's own summary of his ideas is:

I agreed with those writers who tie meaning to use, and introduced the idea of cognitive role as what determines use. But I did not agree that meaning is exhausted by use, since this leaves out reference. I then motivated reference in a different way, as the means by which language conveys the condition of the world. It emerges, then, that the notion of meaning, like that of belief-content, is structurally duplex: it comprises two distinct components, each component introduced to serve a different purpose and each to be theorized in conceptually different ways. (McGinn, 1982, p. 229)

⁸ Saarinen (1982) would agree with the point made by Kripke (1971, 1972) that one must distinguish metaphysical and epistemological factors (in fact Kripke argues for the clear distinction of metaphysical, epistemological and logical or analytic factors). What Saarinen proposes additionally is that epistemic modality, not metaphysical modality, is the relevant one for semantics. A crucial role in the semantics is given to the notion of how an individual is individuated: de re propositional attitudes concern individuals as individuated in a certain way, not individuals simpliciter. The direct reference theory, which speaks of "bare" individuals, ignores how individuals are individuated and is, Saarinen says, 'an effort to do semantics without any epistemology' (Saarinen, 1982, p. 271). Saarinen thus rejects the possible worlds framework for semantics, because it can only deal with metaphysical possibilities. Haecceitism may be retained in metaphysics, if we so desire; but it is utterly inappropriate in semantics. The terrible price Saarinen is willing to pay is the detachment of realist semantics from (metaphysical) reality.

⁹ The theory of reference is unfit to serve this role. There are constraints on the theory of sense originating with the goal of the theory -- to make sense of speakers, -- which exclude most formulations of the theory of reference; speakers would sometimes

simply not be intelligible if we used the theorem

'Hesperus is visible' is true iff Phosphorus is visible.

in the theory of sense. What the speaker is alleged to have said must mesh appropriately with the propositional attitudes we ascribe to him. See the next two paragraphs in the text.

¹⁰ For a fuller discussion of this question, see McDowell (1977), especially sections IV and IX.

¹¹ See, for example, Evans (1981), p. 281 note, where Evans says that Frege is committed to this notion of sense.

¹² See notes 4, 5, and 6.

¹³ I shall use \underline{x} as a variable or parameter in representing attitude relations; thus we shall have both \underline{x}_r and \underline{x}_0 .

¹⁴ Barwise and Perry do not explain very well exactly what this means; they say:

While the organism's environment is real, independent of the organism, the organism/environment pair has a richer structure, for the needs and abilities of the organism are correlated with certain uniformities that the organism recognizes. That is, there are structural features of the organism that correspond to structural features of its environment. (S&A, p. 233)

Michaels and Carello, in their book on ecological psychology talk of 'dual complementation':

If the organization of the animal were indifferent to the organization of the environment, the problem of control would be immensely complicated. Rather, the relationship must be of a special kind so that each component constrains or tailors the other. This dual complementation (Turvey, Shaw, & Mace, 1978) is the source of the complex coordinations exhibited by individual components of ecosystems. (Michaels and Carello, 1981, p. 145)

The basic idea seems to be an emphasis of the integrated relationship of animal and environment.

¹⁵ This information that is not part of the interpretation of an utterance of the name in situation semantics, but for the information to be available to anyone who understands the language, it must be part of the meaning of the name. Notice that a descriptive theory of names would contain the information that someone was once a Cicero in the semantic value. Let $\underline{C}(x)$ abbreviate the descriptions associated with 'Cicero'; then an utterance of 'Cicero φ 's' would express the proposition

$$(\exists x)(\underline{C}(x) \ \& \ \varphi(x)),$$

from which it is an easy matter to infer $\exists x \underline{C}(x)$.

¹⁶ What follows is only an outline of the treatment suggested.

¹⁷ See Barwise (1984), from which the quotation in the text is taken.

Notes to Chapter Eight

¹ This problem arises in cases of sentence embedding operators other than attitude verbs, for example, the modal operators \Box and \Diamond . The problem is that if φ is true and, moreover, necessarily true, then $\Box\varphi$ is true. But substitution of another true sentence ψ for φ does not mean that the truth of the whole sentence will be preserved: $\Box\psi$ will sometimes be false, because ψ , although true, is not necessarily true.

The solution adopted by referential semantics has been Frege's: the doctrine that the reference of a sentence in the context $\Box...$ is not its ordinary reference, but its ordinary sense and the consequent abandonment of innocence. Frege's proposal has been worked out within the possible worlds framework, with intensions representing intensions. The details are familiar and I shall not go into them here.

² Just what conditions are required on the agent's relation to the object is uncertain. There are clear cases on the extremes and a large vague area inbetween. For example, if Ralph clearly sees Ortcutt lurking near a military installation, his belief that Ortcutt is a spy is de re, it is of Ortcutt. "Physical contact" is sufficient in this case, but how close must the agent be, how much must he see of the object? If Ralph, a guard at the installation sees a distant object through binoculars only for a moment before it is occluded, but believes it was a spy that he saw, is his belief still a belief of Ortcutt, if it was indeed Ortcutt? On the other hand, if Ralph is told that the richest man in town is a spy, and believes this, without knowing who is the richest man in town, his belief is not of the richest man in town.

The question has received much attention in the literature: Kaplan (1969) introduces the notions of vividness and standard names in an attempt to distinguish the two cases. Boer and Lycan (1975)

ask what is required for the agent to know who someone is. Burge (1977) is an excellent article on this point:

On seeing a man coming from a distance in a swirling fog, we may plausibly be said to believe of him that he is wearing a red cap. But we do not see the man well enough to describe or image him in such a way as to individuate him fully. Of course, we could individuate him ostensively with the help of the descriptions that we can apply. But there is no reason to believe that we can always describe or conceptualize the entities or spatiotemporal positions that we rely on in our demonstration. [...] Even perception under optimal conditions is subject to the point. The perceived object (say, a book) may not be inspected in sufficient detail to distinguish it from all other objects except by reference to spatiotemporal position. And this, as before, will often not be individuatable by the perceiver except by context-dependent, nonconceptual methods. (Burge, 1977, pp. 351,352)

Finally, I shall just mention that Evans (1982) also discusses the matter (see especially chapter four).

³ The terminology derives from David Lewis (1979).

⁴ The causal theory of reference and the theory of direct reference (Kripke, 1971, 1972; Kaplan, 1977) have displaced the descriptive view. Kaplan's view (Kaplan, 1977, section XXII On Proper Names, pp. 93-99) is that proper names are not indexical, but ambiguous. Which Jon the speaker refers to by uttering

Jon researches in formal semantics.

is not determined by the character of 'Jon' and a feature of the context (which is the case with indexical expressions, eg. 'I'). Instead, the context determines which 'word' was uttered. 'Jon' is ambiguous, let us suppose, between Jon_1 = Jon Barwise and Jon_2 = Jon Oberlander. Once the context has disambiguated pre-semantically between Jon_1 and Jon_2 , the referent is decided.

The causal theory of reference tells us, in terms of contextual features (including the speaker's intentions)

which word is being used in a given utterance. Each such word is directly referential (thus it has a fixed content), and it also has a fixed character. Therefore, in the case of proper name words, all three kinds of meaning -- referent, content and character -- collapse. (Kaplan, 1977, pp. 97,98)

This collapse of the level of meaning means that in oblique contexts the Fregean sense of a name, the content of the name on Kaplan's scheme, is also the referent, the bearer of the name, and the Fregean solution fails. The informativeness of 'Hesperus is Phosphorus' is unexplained. Kaplan says, 'Proper names do not seem to fit into the whole semantical and epistemological scheme as I have developed it'. (Kaplan, 1977, p. 98)

⁵ Lynn Rudder Baker says, 'On every classical [Baker's terminology for non-latitudinarian] account of de re belief I know of, (32)-(34) are justifiable ascriptions of de re belief.' (Baker, 1982b, p. 369)

⁶ Baker's remark is found early in the paper, in a footnote on p. 381.

⁷ See Lynn Rudder Baker (1982b), pp. 364-368.

⁸ I am grateful to Barry Richards for pointing this out to me.

⁹ How might the notion of information be given a semantic role? The following is a sketch of a possible method. Our point of departure is the perspective that Barwise has recently taken (1983b), that information is the crucial concept for understanding meaning and that our theories of language and cognition should be worked out within an informational framework. Consequently, a great deal of information will be involved with meaning, though only some of this is actually part of the interpretations of utterances at present. The level of interpretation reflects what is said about the world and this is specified in terms of objects having properties and standing in relations to one another. but there is much more to the notion of information than this. If we could expand our concept of the interpretation to include more, perhaps all, of the (inverse)

information associated with utterances, then we would have given information a semantic role. This view breaks radically with the usual conception of the world in semantic theory, even with Barwise and Perry's view that the world consists of objects standing in relations. It is more akin to Gibson's conception of what the world is like.

¹⁰ A complication arises in natural language on the identification of & with English 'and' if there are pronouns in one of the subsentences, ψ say, which can take an antecedent in ϕ when the conjunction is formed as ϕ & ψ , but cannot be coreferential with that singular term when the conjunction is formed in the other way, as ψ & ϕ . Thus, with regard to the sentences

(1) Peter has a lot of talent and he should go far.

(2) He has a lot of talent and Peter should go far.

the pronoun 'he' may be coreferential with 'Peter' in utterances of (1), but cannot be so in utterances of (2). We are not used to this phenomenon in logic: our understanding of the meaning of the logical constants of formal languages is worked out against a background of non-efficient expressions.

Other syntactic structures are affected by this issue of potentially coreferential pronouns. For example:

(3) Realising that Oscar was unpopular didn't disturb him.

(4) Realising that he was unpopular didn't disturb Oscar.

See Radford (1981), chapter eleven, for a range of other constructions.

¹¹ The puzzle is more acute for that view of semantics which I have called narrow. The problem, which is shared with direct reference semantics, is that if there is only Perry himself in the proposition expressed by both 'Perry is making a mess' and by 'I am making a mess' (said by Perry), then there can be no semantic solution to the

puzzle. The wide approach at least allows more factors within the domain of semantics, from which a solution may be possible. (I do not think that direct reference theory is committed to narrow semantics, although it embraces singular propositions; on the contrary, Almog's work, which invokes causal chains at the level of meaning, is 'wider' than Kaplan's.)

¹² The passage is worth quoting in full:

Why should we have a special category of self locating knowledge? Why should we care how someone apprehends a thought, so long as he does? [...] We use senses to individuate psychological states, in explaining and predicting action. It is the sense entertained, not the thought apprehended, that is tied to human action. When you and I entertain the sense of 'A bear is about to attack me,' we behave similarly. We both roll up in a ball and try to be as still as possible. Different thoughts apprehended, same sense entertained, same behavior. When you and I both apprehend the thought that I am about to be attacked by a bear, we behave differently. I roll up in a ball, you run to get help. Same thought apprehended, different sense entertained, different behavior. (Perry, 1977, p. 494)

Evans (1981) defends Frege's identification of sense and thought, and criticises Perry's proposal that we need to distinguish them. In the terminology of Perry (1979), the distinction is between belief state and object of belief.

¹³ Of course, Barwise and Perry can mimic Baker's proposed solution in situation semantics using schemata and anchors. We formulate the intentional part of the explanation with schemata and we make connections with the actual state of affairs with anchors. Schemata will be used to capture Jones' identification of the objects in the various ways. His belief state is represented by the situation:

$e := \text{at } l: B_r, j, S; \text{ yes}$

where $l \circ l_q$, j is Jones, and $S = \{E\}$; E is defined by:

$E := \text{at } l: \text{basket}, a; \text{ yes}$

more-valuable, a; yes

dish, b; yes

more-valuable, b; no

holding, i, c; yes

more-valuable, c; yes

where $f(a)$ = the basket, $f(b)$ = the dish, and $f(c)$ = the dish. Jones thinks that the object he is holding is the basket, but his belief that it is the more valuable is erroneous.

¹⁴ This is one of several points in the book where the authors are already thinking in terms of utterances designating situation types (cf. Barwise, 1984).

¹⁵ Or if there is, external significance -- stories, etc. -- it is not what we were expecting.

¹⁶ Even knowledge may involve an appeal to the non-veridical in its characterisation. Thus, one may know that there are no unicorns, even, in a certain sense, that Zeus was married to Hera, or that Gabriel Oak eventually married Bathsheba Everdene in Thomas Hardy's Far from the Madding Crowd.

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